NORTHERN KENTUCKY UNIVERSITY

HAZARD MITIGATION PLAN 2018

Prepared by
Northern Kentucky University
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Stantec

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1. Executive Summary

1.1. Why to produce a Hazard Mitigation Plan

To Reduce Risk

Disasters can cause loss of life; damage to buildings and infrastructure; and have devastating consequences for a community's economic, social, and environmental well-being. Hazard Mitigation reduces disaster damages and is defined as a sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards.

Hazard mitigation is any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards (44 CFR 201.2).

While local governments, regions, and the state have the responsibility to protect the health, safety, and welfare of their citizens, universities equally share this same responsibility for their student, staff, faculty, and visitors. Proactive mitigation policies and actions help reduce risk and create safer, more disaster resilient communities. Mitigation and floodplain management is an investment in the university's future safety and sustainability. In completing the Northern Kentucky University (NKU) Hazard Mitigation Plan (HMP) the university is protecting, reducing and preventing damage to the university's unique economic, cultural and environmental assets.

Disaster Mitigation Act of 2000

The purpose of the Stafford Act, as amended by the Disaster Mitigation Act of 2000, is "to reduce the loss of life and property, human suffering, economic disruption, and disaster assistance costs resulting from natural disasters."
Section 322 of the Act specifically addresses mitigation planning and requires state and local governments to prepare multi-hazard mitigation

Hazard mitigation is crucial to the faculty, staff, and students that commute to and/or reside in and around NKU. Hazard mitigation activities may be implemented prior to, during, or after an event. However, it has been demonstrated that hazard mitigation is most effective when based on an inclusive, comprehensive, long-term plan that is developed before a disaster occurs.

To be in accordance with Federal Standards

Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act enacted under the Disaster Mitigation Act of 2000 (DMA 2000) established revitalized approaches to mitigation planning with a new requirement for Local Mitigation Plans. The NKU Hazard Mitigation Plan (HMP) was developed and funded through the Pre-Disaster Mitigation (PDM) grant program which is grant under the Hazard Mitigation Assistance (HMA) grants program of the Federal Emergency Management Agency (FEMA). DMA 2000 emphasizes greater interaction between State and Local mitigation planning entities highlighting the need for improved linkages between risk assessments and assessing one's capability to deal with the identified hazards.

1.2 What is the purpose of the NKU HMP

The purpose of the NKU HMP is to set a strategy for building a more resilient campus community that will mitigate damages and losses caused by natural hazard events. The HMP is the result of a systematic evaluation of the nature and extent of the vulnerability posed by the effects of hazards (risk assessment) and includes a five-year action plan to minimize future vulnerability (mitigation strategy), accompanied by a schedule that outlines a method for monitoring and evaluating plan progress (plan maintenance).

1.3 Which hazards does the NKU HMP addresses

The NKU HMP assesses risk and outlines mitigation actions to address 11 identified hazards with a historical record or the potential to cause damage to the university community (see listing below). The hazard categories included in the plan are consistent with the 2018 Commonwealth of Kentucky Enhanced Hazard Mitigation Plan.

- Earthquake
- Extreme Heat
- Extreme Cold
- Flood
- Hailstorm
- HAZMAT
- Karts/Sinkhole
- Landslide
- Severe Storm
- Severe Winter Storm
- Tornado

1.4 How is the NKU Hazard Mitigation Plan organized

The HMP contains the following five sections, plus appendices

- Planning Process
- Risk Assessment
- Capability Assessment
- Mitigation Strategy
- Plan Maintenance
- Plan Approval

> Mitigation Planning Requirements
> 44 CFR Part 201
> Text boxes in this color and shape are used throughout the plan to summarize the regulations in 44 CFR Part 201.
> Exact CFR references applicable to each section help the reader understand the rule and/or planning requirements.

The **Planning Process** includes a narrative of how the plan was produced, who was involved, and what other policies and programs were reviewed to inform the plan. Key stakeholders were identified and organized into a stakeholder group and were invited to attend four publicly advertised meetings. Input provided during these meetings, work sessions, and other individual stakeholder meetings drove the formation of the risk assessment, mitigation strategy, and plan maintenance sections of the plan.

The **Risk Assessment** includes developing a profile for the 11 identified hazards as well as the identification, compilation, and integration of the existing hazard databases into one managed, university database contained in Geographical Information Systems (GIS). Once the hazards were identified, vulnerability was assessed on a building-by-building basis with extra weight placed on critical facilities. These maps provided the necessary information for the stakeholder group to examine past occurrences of hazards and assess probabilities in order to determine appropriate mitigation strategies to pursue in the future.

The **Capability Assessment** helps determine the ability of the university to implement a comprehensive mitigation strategy and to identify potential opportunities for establishing or enhancing specific mitigation policies, programs, or projects.

The **Mitigation Strategy** includes the determination of hazard mitigation goals and actions as identified during the planning process and based on a review of the risk assessment results. The plan developers also took inventory of NKU's current capabilities.

The **Plan Maintenance** section outlines the steps for plan implementation which includes monitoring, evaluating, and updating the plan. The plan will be maintained through collaborative efforts of the university departments to allow for better incorporation of existing planning mechanisms.

The **Plan Approval** section demonstrates NKU's commitment to endorsing and fulfilling the mitigation strategy. A signed copy of the formal adoption is included in Appendix A.

2. INTRODUCTION

2.1 University Profile

To provide context for the NKU HMP, the university is briefly described below by its mission, history, campuses and properties, department structure, campus population, occupancy, research and economic impact, infrastructure and critical facilities. The following subsections outline each of these profile attributes. For more information, visit Northern Kentucky University in the website.

Mission

As a public comprehensive university located in a major metropolitan area, Northern Kentucky University delivers innovative, student-centered education and engages in impactful scholarly and creative endeavors, all of which empower our graduates to have fulfilling careers and meaningful lives, while contributing to the economic, civic, and social vitality of the region.

Planning Context

NKU is nested in the hills of Northern Kentucky in Highland Heights which is part of Campbell County. The campus is located in a strategic location. It is seven miles south of Cincinnati, OH, three miles south of the Ohio River and runs parallel to the East of I-275 which connects Kentucky and Ohio.

NKU campus is located in the mid-west section of Highland Heights and slightly isolated from high density commercial and residential areas. The campus boundaries include I-275 which runs along the campus to the west, University Drive to the north and east, and John Hills Road to the south. These roads form semi-defined boundaries.

University Drive serves as a divider mark between the campus and the rest of the city. To the west of University Drive there is single-family, multi-family residential and some commercial areas.
Louis B. Nunn Drive intersects the campus midpoint, and it is the main port of entry to the campus and the main communication with Highland Heights downtown area where most commercial and entertainment is located.

Northern Kentucky University Campus Area Statistics	
2017 Enrollment	14,488
2017 Faculty Headcount	1332
2017 Staff Headcount	926
Existing Main Campus Buildings Gross Square Feet (GSF)	3,480,000
Campus Size	404 Acres
Main Campus Non-residential Buildings	35
Main Campus Residential Buildings	12
University Housing (beds)	1,961
Sources: NKU Office of Institutional Research & Facilities Management	

Current Student Enrollment

Students: Fall 2017

- Students enrolled: 14,488
- Undergraduates: 12,572
- Graduate: 1,472
- Law: 444
- Female: 8,355
- Male: 6,133
- Full-time: 9,758
- Part-time: 4,730
- Students from 44 states
- Students from 61 countries
- From Kentucky: 9,910
- From Boone, Campbell, or Kenton counties: 7,107

Faculty: Fall 2017

- Full-time faculty: 568
- Student-faculty ratio: 19 to 1

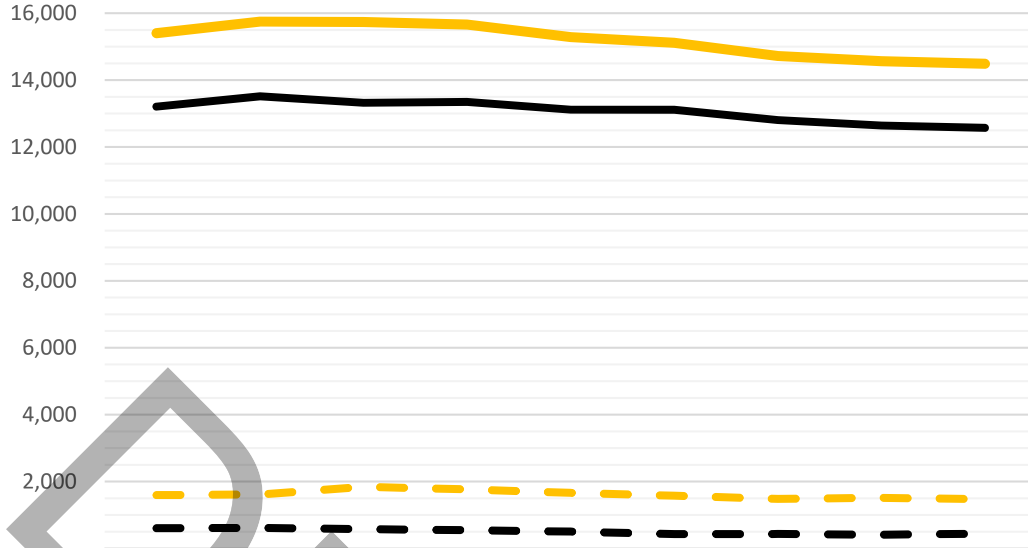
Student Life

- 1,961 residence hall spaces
- 14.6 percent of the undergraduate student population reside in University Housing (as of Fall 16) (All Students)
- 19.9 percent of the FULL-TIME undergraduate student population reside in the University Housing (as of Fall 16)
- Over 220 campus clubs and organizations

Other Information

- Fiscal year 2013-2014 budget: $225,000,000
- Portion of budget from regular state appropriation: $48,537,600 (20.9%)
- Portion of budget from tuition and fees: $139,036,300 (62%)
- Total employees as of November 1, 2013: 2,108
- 94% of spring 2014 senior survey respondents indicated they would recommend NKU to another student

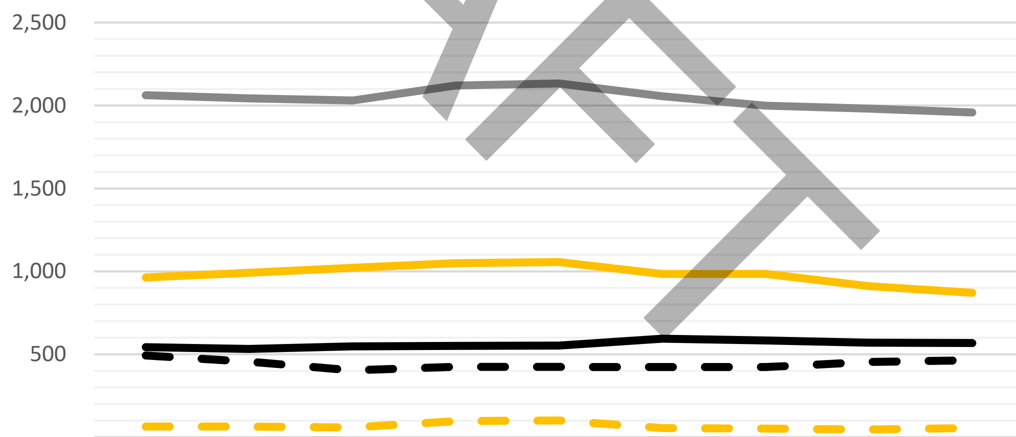
Student Enrollment 2009 - 2017



	2009	2010	2011	2012	2013	2014	2015	2016	2017
Law	606	616	575	548	506	426	434	411	444
Graduate	1,593	1,615	1,841	1,768	1,661	1,578	1,480	1,512	1,472
Undergraduate	13,206	13,517	13,322	13,344	13,116	13,110	12,806	12,643	12,572
Overall	15,405	15,748	15,738	15,660	15,283	15,114	14,720	14,566	14,488

Source: NKU Office of Institutional Research

Employee Headcount 2009 - 2017



	2009	2010	2011	2012	2013	2014	2015	2016	2017
Faculty Full-Time	542	532	547	550	552	594	583	569	568
Faculty Part-Time	493	456	403	425	424	423	423	454	464
Staff Full-Time	963	991	1,021	1,049	1,056	984	984	911	871
Staff Part-Time	64	64	59	97	101	55	51	47	55
Total	2,062	2,043	2,030	2,121	2,133	2,056	1,999	1,981	1,958

Source: NKU Office of Institutional Research

Summary of Fiscal Year 2017 - 2018 Unrestricted Revenues and Expenditures

Sources of Funds	Annual Budget	Percent of Total	Percent of Revenues	
Education & General				
Government Appropriation - Regular	$51,621,100	24.98%	22.80%	
Tuition	$138,067,200	66.82%	60.80%	
Camps Recreation Mandatory Fee	$4,397,600	2.13%	1.94%	
Other Fees	$991,400	0.48%	0.44%	
Sale and Services of Educational Activities	$4,644,600	2.25%	2.05%	
Other Sources	$6,899,100	3.34%	3.05%	
Total Educational & General	**$ 206,621,000**	**100.00%**	**91.08%**	
Sale and Services of Auxiliary Enterprises				
Housing	$ 10,529,100	62.75%	4.65%	
Food Services	$ 2,363,900	14.09%	1.04%	
Bookstore	$ 452,000	2.69%	0.20%	
Vending Operations	$ 340,000	2.03%	0.15%	
Parking Services	$ 3,094,000	18.44%	1.37%	
Total Auxiliary Enterprises	**$ 16,779,000**	**100.00%**	**7.41%**	
Total Revenues	**$223,400,000**			
Plus: Nonrecurring sources (net assets)	**$3,000,000**	**1.33%**		
Total Sources of Funds	**$226,400,000**	**100.00%**		

Expenditures by Major Object	Annual Budget	One-Time Special Allocation	Total Annual Budget	Percent of Total
Personnel Services	$96,783,900	$824,800	$97,608,700	43.11%
Benefits	$44,470,900	$204,300	$44,675,200	19.73%
Contract Services	$3,245,000	$3,000	$3,248,000	1.43%
Operating	$26,128,700	$1,953,700	$28,082,400	12.40%
Utilities	$5,958,300	$14,200	$5,972,500	2.64%
Capital	$3,443,000	-	$3,443,000	1.52%
Student Financial Aid	$27,016,800	-	$27,016,800	11.93%
Transfers (Debt Service)	$13,996,800	-	$13,996,800	6.18%
Reserves (E&G)	$2,356,600	-	$2,356,600	1.04%
Total Expenditures	**$223,400,000**	**$3,000,000**	**$26,400,000**	**100.00%**

Expenditures by Major Function	Annual Budget	One-Time Special Allocation	Total Annual Budget	Percent of Total
Education and General				
Instruction	$66,745,600	695,400	$67,441,000	29.79%
Research	$185,700	-	$185,700	0.08%
Public Service	$7,025,900	$407,200	$7,433,100	3.28%
Libraries	$6,076,100	-	$6,076,100	2.68%
Academic Support	$20,709,700	-	$20,709,700	9.15%
Student Services	$21,654,900	-	$21,654,900	9.56%
Institutional Support	$27,811,800	$586,000	$28,397,800	12.54%
Operations and Maintenance of Plant	$19,485,900	$1,311,400	$20,797,300	9.19%
Student Financial Aid	$26,574,100	-	$26,574,100	11.74%
Mandatory Transfers	$6,113,500	-	$6,113,500	2.70%
Non-Mandatory Transfers	$1,881,200	-	$1,881,200	0.83%
Reserves (E&G)	$2,356,600	-	$2,356,600	1.04%
Total Education and General	**$206,621,000**	**$3,000,000**	**$209,621,000**	**92.58%**
Auxiliary Enterprises				
Student Services	$10,386,600	-	$10,386,600	4.59%
Student Financial Aid	$423,100	-	$423,100	0.19%
Transfers	$5,969,300	-	$5,969,300	2.64%
Total Auxiliary Enterprises	**$16,779,000**	**-**	**$16,779,000**	**7.42%**
Total Expenditures	**$223,400,000**	**$3,000,000**	**$226,400,000**	**100.00%**

Critical Facilities

Prior to updating the risk assessment, NKU Stakeholder Group members reviewed and updated a listing of critical infrastructure and facilities to determine which structures were to be designated as critical facilities. The planning team approved the following definition for critical facilities:

> *Assets to the university, essential to its functioning and the destruction of which would cause a serious impact on the continued operation of the university. Buildings selected under this definition include: Campus police, fire, emergency operations, major technology nodes, and structures containing major campus power feeds/supplies.*

Below are the buildings that have been identified as 'critical' by the planning team:

Bldg. No.	Bldg. Name	City
0130	Nunn Hall	Highland Heights
0330	Business Academic Center	Highland Heights
0360	Lucas Administration Center	Highland Heights
0381	New Power Plant	Highland Heights
9995	Electrical Substation	Highland Heights
9996	Electrical Substation	Highland Heights

Development Trends

An examination of development trends provides NKU the basis for making decisions on the type of mitigation approaches to consider, and the locations where these approaches can be implemented. Campus master planning at NKU has developed long-range strategies for the growth and transformation. Common to all recent plans is a belief that no single issue can be considered in isolation. Physical planning interrelates buildings, infrastructure, open spaces, transit, site ecology, storm water management, and other hazards.

The history of campus planning at NKU dates to 1971, when the first Master Plan was prepared. In 1979, 1987 and 2000 major revisions were done. The most recent Master Plan (2009) involved a 16-month planning process where campus and community participated in different activities such as campus sessions and one-on-one small group interviews. Some goals of the 2009 Master Plan included creating a compact, well organized and accessible campus, achieving a sense of community within the campus and the surrounding area, and the region, creating a sustainable campus, and working with the city to achieve a mutually satisfying and supportive living and working environment.

Recent additions to the NKU campus include the Health Innovation Center (124,250 square feet) in 2018, the Student Recreation Center addition to Albright Hall in 2015, and Griffin Hall (133,600 square feet) in 2011. Griffin Hall is home of the College of Informatics and is NKU's first LEED (Silver) certified building. In 2008, the university opened BB&T Arena (243,000 square feet), a 10,000 seat multi-purpose arena and the Student Union (144,000 square feet).

3. PLANNING PROCESS

A comprehensive description of the planning process informs citizens and other readers about the way the plan was developed. Retention of leadership, staffing, and in-house knowledge may fluctuate over time. Therefore, the description of the planning process serves as a permanent record that explains how decisions were reached through stakeholder input.

Capturing the narrative of the planning process is crucial. The following sections describe the Northern Kentucky Hazard Mitigation Plan (NKU HMP) plan development process by summarizing the contributions of the Planning Team, NKU Stakeholder Group, community participation, outreach methods, and the incorporation of planning mechanisms.

Mitigation Plan Documentation

§201.6(b) requires the plan to contain a discussion of how the planning process involved local agencies and other interests and how the planning process allowed for public comment.

§201.6(c)(1)-The Hazard Mitigation Plan shall document the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

3.1 Documentation of the Planning Process

The NKU hazard mitigation planning process was coordinated by NKU Safety and Emergency Management and Stantec. Duties included meeting and work session facilitation, data collection, risk assessment analysis, mitigation strategy development, plan maintenance strategy, and plan assembly. The following lists members of the Planning Team:

Jeff Baker	Safety & Emergency Management
Anna Wright	Marketing & Communications
John Gaffen	University Police
Syed Zaidi	Facilities Management
Josh Human	Stantec
John Bucher	Stantec

While the planning team was responsible for leading and facilitating the plan development process, input from our strategic NKU Stakeholder Group ensured that the plan represents the entire university.

Once the planning team identified faculty and staff to be represented in the NKU Stakeholder Group, an email was sent to each, requesting commitment to the plan development process, that included a schedule of four NKU Stakeholder Group meetings throughout a twelve month period (See Appendix B for meeting records and invites).

To expand the reach across the general campus community, the planning team posted meeting information on publicly accessible websites, social media, and university-wide email listservs, and when needed through telephone calls.

Participants in the plan process include a cross-section of the university community; most prominently key staff from university departments who are responsible for implementing the five-year action plan, and other local, regional, and state agencies; all that represent the community-at-large. See Appendix C (NKU Stakeholder Group List and Attendance) for the list of key stakeholders that helped develop the plan.

3.2 Public and Stakeholder Meetings

To ensure stakeholder involvement, the planning team conducted two public meetings in addition to four stakeholder group work sessions. This section describes each meeting and how the contributed to development of the NKU HMP. For meeting documentation see Appendix B.

Planning Team Kick-Off Meeting - January 30, 2018, 10:00 am - 12:00 pm
This meeting served as an overview of hazard mitigation planning in Kentucky and the history of university plans. There was a quick discussion of data needs for the vulnerability assessment. NKU has a few different databases with building data that they are working to consolidate into a central database. It was discussed that NKU would also like to add hazard layers to their GIS inventory. It was discussed that Stantec will need to coordinate with other data collection efforts and pull data from multiple sources for the assessment. NKU is undergoing re-accreditation and has pulled some data for that process that may be useful for the HMP.

The audience brought up some question about including terrorism in the vulnerability assessment as a hazard. The group decided to focus on effects and impacts, as they can be similar to those caused by several hazards. Response related actions in the mitigation strategy relate to multiple hazards, including terrorism. For example, a continuity of operations plan for the data center may be included as an action, as well as related equipment, such as generators.

Finally, there was some discussion of the importance of a strong outreach effort to involve stakeholders, including some retired staff with institutional knowledge and key community leaders outside of the university. It was necessary to highlight that NKU staff will be finding funds for projects from outside sources (HMGP, PDM) that will benefit the university. Stakeholders will be asked to send an alternate to meetings if they cannot attend.

NKU Stakeholder Group Kick-Off Meeting - March 20, 2018, 10:00 am - 12:00 pm
The purpose of this meeting was to introduce the NKU Stakeholder Group to the concept of mitigation, explain the planning process, and discuss hazards affecting NKU.

Jeff Baker (NKU) started the meeting by briefly explaining the benefits of having a Hazard Mitigation Plan in place. He mentioned that in December, NKU put out a Request for Proposal and Stantec was selected as the firm to help NKU in developing the university's first hazard mitigation plan (HMP).

Josh Human (Stantec) gave a presentation about hazard mitigation planning. First, he emphasized the importance for a university to have a hazard mitigation plan in place, especially with the high number of recent disasters and the availability of government hazard mitigation funding.

Among the attendees, there were a group of key campus figures including the Manager for Research Compliance and Biosafety, the Student Enrollment Coordinator, the Business and IT Manager, the Facilities Manager, the Sustainability Coordinator, and the Insurance Claims Assessor. Additionally, some authorities of the City of Highland Heights were also present including the Public Works Director, Fire Chief, Police Chief, and EMS Director.

Josh Human's presentation included a Hazard Mitigation 101 description, a clarification of the difference between risk and mitigation, and a detailed step by step explanation of the planning steps to complete the NKU HMP including Planning Process, Risk Assessment, Mitigation Strategy, Plan Maintenance, and Plan Adoption. Josh Human also explained the Vulnerability Score and the tools used during the planning process. He continued to go over each one of the hazards and ask the audience for input. Forest Fires, Drought and Mine Subsidence were dropped from the original list of hazards because they don't represent a risk to NKU Campus.

There was a question about how to identify sinkholes on campus. The Stantec team explained that through data analysis, it was possible determine if the NKU campus is in a sinkhole prone area. Another attendant noted the existence of a sinkhole on campus. Another member of the audience asked if biohazard materials such as viruses are part of the HMP. Mr. Human addressed the question by saying that this was not part of the HMP, but that some data collected and produced by the plan can be useful in biohazard projects.

After the break, John Bucher (Stantec) introduced an activity to let the audience vote on how concerned they felt with each of the hazards. The exercise served to rank the hazards to help with prioritizing projects in the Mitigation Strategy. Results of the voting and the HMP's hazard ranking are presented below.

Rank	Hazard	Score
1	Severe Storm	59
2	Sever Winter Storm	50
3	Tornado	49
4	Haz/Mat	40
5	Earthquake	37
6	Hail	34
7	Flood	31
8	Extreme Heat	27
9	Landslide	25
10	Extreme Cold	24
11	Karst/Sinkhole	20

After voting, members were invited to look at three different maps where they could pinpoint exact hazard locations. To conclude the meeting, the Stantec team asked the audience for resources to acquire data for the risk assessment map. The meeting ended by announcing that the Public Survey is available online.

Public Kick-Off Meeting - March 20, 2018, 10:00 am - 12:00 pm
The purpose this meeting was to introduce attendees to the concept of hazard mitigation and the planning process, as well as to discuss hazards affecting the NKU campus.

Jeff Baker (NKU) started the meeting by briefly explaining the benefits of having an HMP in place. Josh Human (Stantec) proceeded to give a presentation about hazard mitigation planning. First, he emphasized the importance for a university to have a hazard mitigation plan in place, especially with the high number of recent disasters and the availability of government hazard mitigation funding.

There was a limited number of attendees. A Chemistry professor expressed his concern about the hazardous materials on campus, which was discussed and noted as a concern. To conclude the meeting, the Stantec team asked the audience for resources to acquire data for the risk assessment map. The meeting ended by announcing that the Public Survey is available online.

NKU Stakeholder Group Risk Assessment Meeting - June 6, 2018, 10:00 am - 12:00 pm
The purpose of this meeting was to present the preliminary results of the risk assessment, gather feedback from the stakeholders, and to introduce the mitigation strategy.

Jeff Baker (NKU) started the meeting by welcoming the attendees and giving a brief explanation of the project. Josh Human (Stantec) then asked the attendees to introduce themselves and tell the group how their role related to hazard mitigation on campus. Mr. Human gave a brief introduction to hazard mitigation planning, the

Disaster Mitigation Act of 2000, and the FEMA Local Mitigation Planning Handbook. He then gave an overview of the risk assessment process and hazard identification.

John Bucher (Stantec) then presented the details of the risk assessment methodology including the exposure score and hazard risk score. He then showed a few examples of the maps created to demonstrate the results of the risk assessment. At that point the attendees were asked to look at the maps to check for accuracy and provide additional details, where possible. Feedback included:

- Nunn Hall's content value is too high
- Founders Hall should have a condition score of 1 because of renovation
- Founders content value needs to be updated
- There was a storm/wind incident that caused a tree to fall on the intramural field
- The intramural field replacement value is about $2million
- The baseball field replacement value is about $750,000
- The soccer field replacement value is about $700,000
- The softball field replacement value is about $150,000
- The tennis courts replacement value is about $150,000.
- The mapped HazMat sites need to be verified

Josh Human introduced the mitigation strategy, including mitigation goals, mitigation actions, and the action plan. He then led the attendees in an exercise to draft NKU's mitigation goals. The group settled on the following goals and will review them prior to the next meeting.

1. Pursue consistent funding from a variety of sources for prevention, maintenance, and mitigation of disasters.
2. Increase public and university awareness through education and support for disaster preparedness practices.
3. Enhance staff capacity and collaboration, policies, and technical capabilities that will mitigate and reduce damages from hazard events.
4. Protect university property, organizational information, and research assets from hazards and threats.
5. Build and sustain partnerships between government, educational institutions, business, and the community.
6. Protect lives and minimize injuries that could be caused by hazard events.

Question about what was meant by "consistent funding sources." This means regular grant application (FEMA and other), capital improvements, and operational budgets, if available. Question about what type of public awareness and education are intended. These could include websites, trainings, and student orientation.

Mr. Human then introduced the mitigation strategy and the mitigation action workbook. He informed the group that he will email the workbook and ask them to add possible mitigation actions. He told the group that he will be sending another announcement about the survey, because we had very few complete surveys so far.

NKU Stakeholder Group Mitigation Strategy Meeting – September 27, 2018, 1:00pm-4:00pm

The purpose of this meeting was to review the actions submitted by the NKU Stakeholder Group for inclusion in the Mitigation Strategy. Jeff Baker (NKU) started the meeting by welcoming the attendees. Josh Human (Stantec) reminded the audience about the importance of having an HMP in place. He then asked the audience to briefly introduce themselves since new people joined the meeting.

Josh introduced the concept of mitigation strategy and presented examples of mitigation strategy actions plans from the University of Kentucky and the University of Louisville. John Bucher (Stantec) then introduced the meeting's activity. The stakeholders were divided into small groups with a facilitator to discuss current mitigation strategies and come up with new ones. Each small group reported out to the larger group at the end of the activity so that the ideas could be discussed and refined. The results of the activity are captured in the Mitigation Strategy workbook found in section 6.3.

NKU Stakeholder Group/Public Draft Plan Presentation –

3.3 Public Survey

In addition to the two public meetings described above, a survey was distributed to the campus community asking for input on the HMP. Unfortunately, only 12 people completed the survey, and several of those did not answer all questions. Because the response rate was so low, the results are not statistically significant, however there were some items where there was consensus among the respondents:

1. Tornadoes are the hazard that is the highest threat to the university;
2. There is some concern about active shooters;
3. More extreme and frequent thunderstorms and heat waves are the aspects of climate change that are the highest threat to the university;
4. Internet and social media are the most effective ways to communicate; and
5. There is general support for Prevention activities (building codes, open space preservation, and others) and Emergency Services activities (warning systems, evacuation planning, emergency response training, and others).

4. Risk Assessment

The 2018 NKU HMP assesses the university's risks and vulnerabilities. This section is to be used as the blueprint for the mitigation strategy. The risk assessment section uses best available data received for the main campus and other NKU facilities. This includes the first-hand knowledge from individual stakeholders, state and national datasets, and the use of Geographic Information System (GIS) for the assessment of the main campus and other properties owned by NKU.

This section of the Plan follows the "Local Mitigation Plan Review Tool" section "Hazard Identification and Risk Assessment" Element B. The requirements for this section are described below:

- Does the Plan include a description of the type, location, and extent of all-natural hazards that can affect each jurisdiction(s)? (Requirement §201.6(c)(2)(i))
- Does the Plan include information on previous occurrences of hazard events and on the probability of future hazard events for each jurisdiction? (Requirement §201.6(c)(2)(i))
- Is there a description of each identified hazard's impact on the community as well as an overall summary of the community's vulnerability for each jurisdiction? (Requirement §201.6(c)(2)(ii))
- Does the Plan address NFIP insured structures within the jurisdiction that have been repetitively damaged by floods? (Requirement §201.6(c)(2)(ii))

Risk Assessment

§201.6(c)(2) requires local jurisdictions to provide sufficient information from which to develop and prioritize appropriate mitigation actions to reduce losses from identified hazards.

This includes detailed descriptions of all the hazards that could affect the jurisdiction along with an analysis of the jurisdiction's vulnerability to those hazards. Specific information about numbers and types of structures, potential dollar losses, and an overall description of land use and development trends should be included in this analysis.

To complete the above elements the planning team decided to use a very similar methodology accomplished in other Kentucky based hazard mitigation plans. This included breaking this section into three areas of examination.

1. Identify Hazard
2. Profile Hazard
3. Assessing Vulnerability

Each identified hazard was developed with one continuous Risk Assessment overview. This provides an independent review of each hazard following the three sections described above (Identify, Profile and Assessing Vulnerability). This allows the end users the ability to review all facets of each hazards complete Risk Assessment within one section.

Throughout the risk assessment, GIS spatial data, when possible, provides the baseline for the risk assessments developed for the HMP. GIS provides the architecture to facilitate an inventory of assets and hazards as well as providing the platform to calculate a building-by-building risk assessment. The maps developed through GIS production are used whenever possible to convey where spatially defined vulnerable areas and hazard extent are located. The maps created from this production also provide a visual tool for analysis of the data. The information developed throughout this section was guided and developed using the best available data acquired from key Stakeholders and other relevant data sources. This included the approved 2017 Northern Kentucky Regional Hazard Mitigation Plan and the Commonwealth of Kentucky Hazard Mitigation Plan.

4.1 Identifying Hazards Overview

This section provides a complete overview and definition of each hazard that could potentially affect the NKU community. A complete understanding of each hazard better prepares decision makers, local agencies and residents on the causes of, potential damages contributed to, and possible scenarios of each hazard.

> Hazard Description Requirement
> §201.6(c)(2)(i): [The risk assessment shall include a] description of the type…of all hazards that can affect the jurisdiction.

A list of common U. S. natural hazards includes:

- Avalanche;
- Coastal Storms;
- Dam Failure;
- Drought;
- Earthquake;
- Extreme Heat;
- Flood;
- Forest Fire;
- Hailstorm;
- Hurricane;
- Mine Subsidence;
- Severe Winter Storm;
- Tornado;
- Tsunami;
- Volcano; and
- Windstorm.

The plan includes identified hazards where there is a historical record of damage caused to people and property or where the potential for such damage exists within the area. Due to NKU's climate, geology, and geographical setting, the university is vulnerable to a wide array of hazards that threaten life and property.

Through research of historic impacts, occurrences, dollar losses to date, review of the past State and Local Hazard Mitigation Plans, and discussions with key agencies and stakeholders, the following eleven (11) hazards are assessed in the 2018 NKU Hazard Mitigation Plan:

1. Earthquake
2. Extreme Heat
3. Extreme Cold
4. Flood
5. Hailstorm
6. HAZMAT
7. Karts/Sinkhole
8. Landslide
9. Severe Storm
10. Severe Winter Storm
11. Tornado

As mentioned before, each hazard will have an individual "Identify" section where the hazard will be described and defined.

4.2 Profiling Hazards Overview

The Profile Hazard section describes each hazard's past, present and future effects on the university community through completing an extensive overview.

The NKU hazard profiles have been created using the best available data from a variety of resources, including but not limited to the NKU Insurance Claim data, local interviews, hazard identification exercise, National Center for Environmental Information (NCEI), National Weather Service (NWS), Kentucky Division of Water (KDOW), Kentucky Office of Geographical Information, Kentucky Geological Survey (KGS), the Commonwealth of Kentucky Hazard Mitigation Plan, and the 2017 Northern Kentucky Regional Hazard Mitigation Plan.

Public input was an invaluable local resource throughout the planning process. Stakeholders participated in workshops, completed a hazard identification exercise, and discussed information gathered from the sources listed above as well as their own general knowledge. Stakeholders discussed issues such as past events and significant occurrences that did not warrant a declared disaster and how those events impacted the university community and properties.

The profile section provides the historical context for identifying the hazards. The following table displays presidential declaration occurrences since 2000 that have occurred within Campbell County Kentucky (NKU's Campus Location), which provides background on the type, of natural disasters that have affected the NKU campus and surrounding area.

Profiling Hazards Requirement
§201.6(c)(2)(i):
[The risk assessment **shall** include a] description of the … location and extent of all-natural hazards that can affect the jurisdiction. The plan **shall** include information on previous occurrences of hazard events and on the probability of future hazard events.

FEMA Local Mitigation Planning Handbook, page 5-3
Extent can be described in a combination of ways depending on the hazard.

FEMA Guidelines	NKU Plan Location
Scientific scale or measurement system	Identifying Hazard section
Measures of magnitude	Hazard Score & Profile Risk Table
Warning time	Profile Risk Table
Duration of event	Profile Risk Table

Presidential Declarations in Campbell County Kentucky	
Year	**Disaster**
1993	Severe Snowfall & Winter Storm
1996	Blizzard of 96
1997	Severe Storm, Flooding, and Tornadoes
2005	Hurricane Katrina
2008	Severe Windstorms associated with tropical depression Ike
2009	Severe Winter Storm and Flooding
2011	Severe Storm, Flooding, and Tornadoes
2012	Severe Storm, Flooding, Straight-line Winds and Tornadoes
2018	Severe Storms, Tornados, Flooding, Landslides and Mudslides
Source: https://www.fema.gov/data-visualization-disaster-declarations-states-and-counties	

In order to stream line, the dissemination of hazard information the planning team developed a common format to display multiple layers of information, including information on extent. The table format allows the end user to view a snap shot of the hazard and how it has impacted the university as well as the county that the university is within, Campbell County. The addition of the county information provides a better overview of hazard information for NKU, as there is more data for the county and it is relevant to the campus area. The following table describes the "Profile Risk Table" along with an explanation of each data element.

Profile Risk Table	
Period of occurrence	When does this hazard occur?
Campbell County Number of Events	Number of events in the Campbell County area based on the 2017 NKADD Hazard Mitigation Plan
Campbell County Probability of Events	Probability of the event occurring within Campbell County based on the 2017 NKADD Hazard Mitigation Plan
Campbell County Past Damages	Report of damages occurring within Campbell County based on 2017 NKADD Hazard Mitigation Plan
NKU Number of Events	Number of NKU incidents per building
NKU Damages Claimed	Amount of damages that NKU has claimed
Warning Time	Average warning time for this type of hazard – factor of Extent
Potential Impact	The potential impact this hazard could produce
Potential of Injury or Death	The potential this hazard could cause injury or death
Potential Duration of Facility Shutdown	The potential duration that this hazard could cause a facility to shut down – factor of Extent
Extent	The worth anticipated strength or magnitude of each identified hazard

The "Profile Risk Table" provides a summary of each hazards profile section. It provides the historical perspective of how the hazard has affected the community (Campbell County) and the university.

The following elements will be found in each hazard profile section:

- A "Profile Risk Table", which summarizes the overall risk.
- A local description of each identified hazard and potential impact.
- Historical background on each identified hazard and a brief description of known events.

Understanding risk and each hazard's potential effect on the NKU community is imperative to the mitigation strategy and provides the information needed to understand the overall risk to the university. The following "Loss Matrix" table provides quantitative data that portrays which hazards have caused the most damages according to found insurance claim data and the hazard identification exercise. This data is used to display which hazards are most destructive based on university insurance claim data and stakeholder knowledge. While this data is limited in quantity, it does provide an identified snap shot of actual occurrences and losses and can be used to estimate potential losses. Also, important to note, many hazards have a very low probability but a potential high magnitude, such as earthquakes.

The data was used by the planning team to prioritize which hazards should receive the most consideration when justifying potential mitigation projects. Due to the fact NKU does not have a lengthy record of loss and occurrence data, this data is used to show a very primitive loss estimation model. In the future, the university is planning on keeping a better record of occurrences and damages to improve their loss estimation methodology.

Hazard Type	Frequency	Damages	Average Loss per event
Earthquake	0	$0	N/A
Extreme Heat	0	$0	N/A
Extreme Cold	1	$26,153	$13,077
Flood	0	$0	N/A
Hail	0	$0	N/A
HazMat	0	$0	N/A
Karst/Sinkhole	0	$0	N/A
Landslide	0	$0	N/A
Severe Storm	3	$26,146	$8,715
Severe Winter Storm	0	$0	N/A
Tornado	0	$0	N/A
TOTAL DAMAGES		**$52,299**	

4.3 Assessing Vulnerability Overview

The Assessing Vulnerability section uses best available data from national, state, and local sources. The model used for the NKU HMP has been used for other university mitigation plans and provides an understanding of relative risk and vulnerabilities from hazards across the university. Uncertainties are inherent in any vulnerability/risk assessment, arising in part from incomplete scientific knowledge concerning natural and man-made hazards and their effects on the built environment. Uncertainties can also result from approximations and simplifications that are necessary when loss and occurrence data are limited.

> **Assessing Vulnerability Requirement**
>
> §201.6(c)(2)(ii): [The risk assessment *shall* include a] description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description **shall** include an overall summary of each hazard and its impact on the community.

One of the most important steps in creating a vulnerability assessment model within GIS is to define the geographic unit of measurement. university hazard mitigation plans provide the unique opportunity to complete a vulnerability assessment at the building level. After review of multiple building data sets, the planning team identified 149 buildings and structures that would be assessed. Implementing the vulnerability assessment at the building/structure level allows the university community to view each building's vulnerability against each identified hazard.

Vulnerability Assessment Methodology

Hazard Vulnerability Score = Exposure Score + Hazard Score

The model was designed to produce a "Hazard Vulnerability Score" for each building in relation to each hazard. The Hazard Vulnerability Score is built on multiple layers of data to provide the end users with various ways of using and interpreting the data.

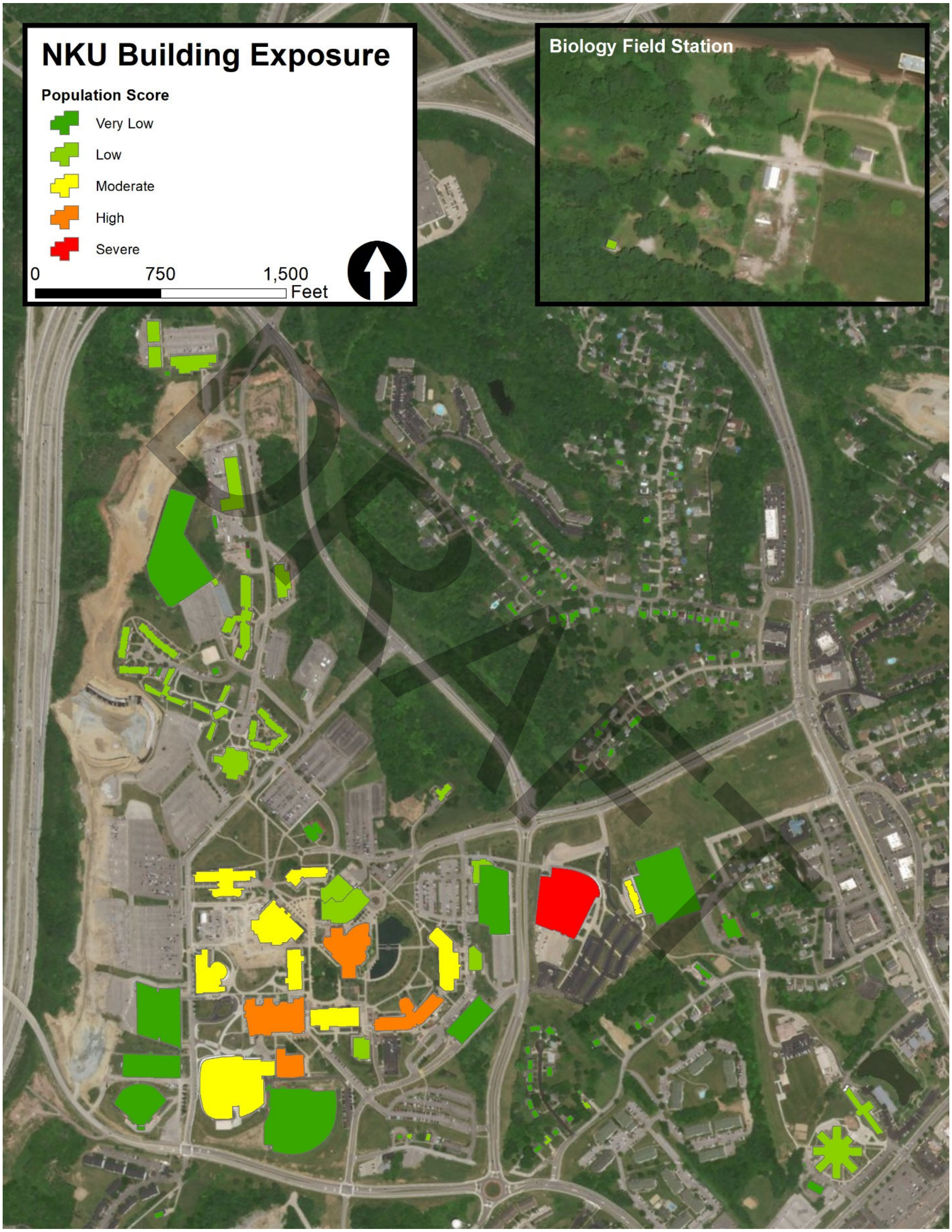
To calculate the Hazard Vulnerability Score, the Exposure Score and Hazard Score are first scored on a 0 to 1 scale individually and then added together. The sums of those scores are then rescored on the 0 to 1 scale.

In order to visualize the data on the Hazard Vulnerability Maps each Hazard Vulnerability Score is categorized into five categories: Very Low, Low, Moderate, High, and Severe, based on the Natural Breaks (Jenks) classification, which breaks data into like classes. These categories are displayed within the legends of the map. By categorizing the buildings on the map into these categories it provides the end user the ability to visually label which buildings are more vulnerable and thus more at risk based on relative risk to each other.

The Hazard Score is determined by the geographic boundaries of each hazard area. For example, for flood, areas within the 1% annual chance flood hazard area receive a flood hazard score of 1, while areas outside receives a score of 0. For karst/sinkhole, areas within the Kentucky Geological Society (KGS) Karst Map area or moderate karst risk receive a score of .5, while areas in the area of high karst risk received a score of 1.

The Exposure Score is a building specific score that represents the combination of weighted scores for all of the five exposure variables: building population, replacement value, content value, critical facility, and building condition. All five exposure variables were scored on the 0-1 scale and then the weight was applied before adding the scores together. Finally, the sum of all five weighted scores were rescored on the 0-1 scale. Figure 4.1 shows the Exposure Score for all NKU buildings/structures. Maps showing scores for each exposure variable may be found in Appendix D.

Building Population Score - NKU provided building occupancy and capacity amounts for all main campus buildings.



. Those amounts were scored on a 0 to 1 scale with the highest number (BB&T Arena) receiving a score of 1. The score was multiplied by .25 before adding with the other variables for the Exposure Score.

Replacement Value Score – NKU provided replacement values for campus buildings and the off-campus rental houses. Those values were scored on a 0 to 1 scale with the highest number (BB&T Arena) receiving a score of 1. The score was multiplied by .25 before adding with the other variables for the Exposure Score.

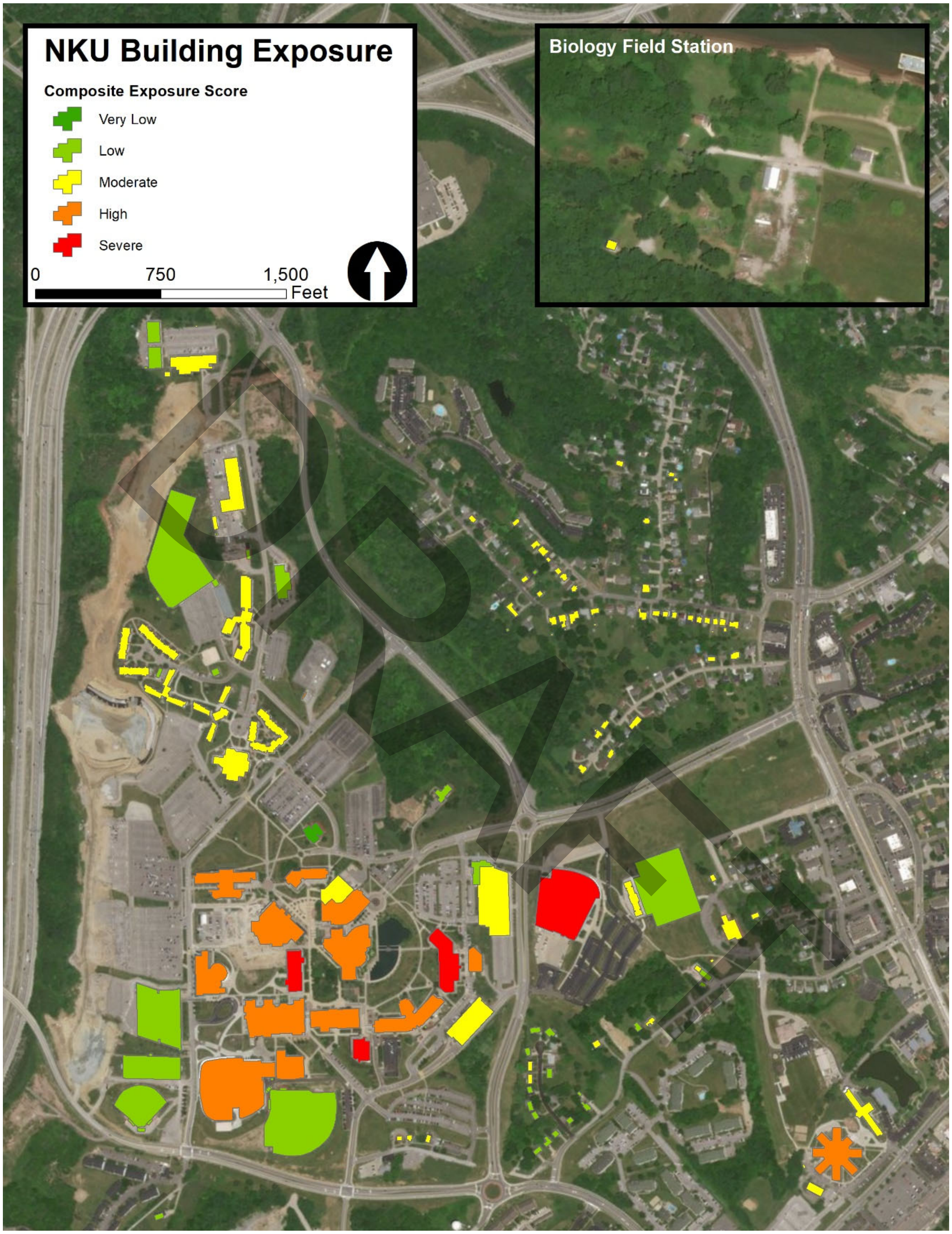
Content Value – NKU provided content values for campus buildings. Content values were not available for off-campus rental houses, so their value was set at $0. Those values were scored on a 0 to 1 scale with the highest value (Lucas Administration Center) receiving a score of 1. The score was multiplied by .0 before adding with the other variables for the Exposure Score.

Critical Facility – NKU designated six critical facilities as described in Section 2 of this document. Critical facilities received a score of 1 and non-critical facilities received a score of 0. The score was multiplied by .2 before adding with the other variables for the Exposure Score.

Building Condition – NKU provided building condition ratings for all campus and off-campus buildings. Those values were scored on a 0 to 1 scale with the best rating (1-Satisfactory) receiving a score of 1 and the worst rating (4-Remodeling C) receiving a score of 0. The score was multiplied by .1 before adding with the other variables for the Exposure Score.

Building Condition	
1	Satisfactory – Suitable for continued use with normal maintenance. Any single item of major or capital renewal is not greater than $40,000. (Catastrophic failures excepted.)
2	Remodeling A – Requires restoration and/or replacement of some building system components in order to meet acceptable standards without major room use changes, alterations, or modernizations. The approximate cost of "Remodeling A" is not greater than 25 percent of the estimated replacement cost of the building.
3	Remodeling B – Requires major updating and/or modernization of the building. The approximate cost of "Remodeling B" is greater than 25 percent, but not greater than 50 percent of the estimated replacement cost of the building.
4	Remodeling C – Requires major remodeling and total replacement of the major building system components. The approximate cost of "Remodeling C" is greater than 50 percent of the replacement cost of the building.
NKU decided not to include buildings already designated for Demolition or Termination in the risk assessment.	
Source: National Council for Higher Education Management Systems (NCHEMS) Building Condition Codes	

Figure 4.1: NKU Building Exposure



Sources: NKU Facilities Management, NKU Office of the Comptroller, NKU Campus Planning, ESRI

4.4 Earthquake

4.4.1 Identify: Earthquake

An earthquake is a sudden, rapid shaking of the earth caused by the breaking and shifting of rock beneath the earth's surface. For hundreds of millions of years, the forces of plate tectonics have shaped the earth as the huge plates that form the Earth's surface move slowly over, under, and past each other. Sometimes the movement is gradual. At other times, the plates are locked together, unable to release the accumulating energy. When the accumulated energy grows strong enough, the plates break free releasing the stored energy and producing seismic waves generating an earthquake. The areas of greatest tectonic instability occur at the perimeters of the slowly moving plates, as these locations are subjected to the greatest strains from plates traveling in opposite directions and at different speeds. However, some earthquakes occur in the middle of plates.

Ground motion, the movement of the earth's surface during earthquakes or explosions, is the catalyst for most of the damage during an earthquake. Produced by waves generated by a sudden slip on a fault or sudden pressure at the explosive source, ground motion travels through the earth and along its surface. Ground motions are amplified by soft soils overlying hard bedrock, referred to as ground motion amplification. Ground motion amplification can cause an excess amount of damage during an earthquake, even to sites very far from the epicenter.

Earthquakes strike suddenly and without warning. Earthquakes can occur at any time of the year and at any time of the day or night. On a yearly basis, 70 to 75 damaging earthquakes occur throughout the world. Estimates of losses from a future earthquake in the United States approach $200 billion.

Ground shaking from earthquakes can collapse buildings and bridges, disrupt gas, electric, and phone service, and sometimes trigger landslides, avalanches, flash floods, fires, and huge, destructive ocean waves (tsunamis). Buildings with foundations resting on unconsolidated landfill and other unstable soil, and trailers and homes not tied to their foundations are at risk because they can be shaken off their mountings during an earthquake. When an earthquake occurs in a populated area, it may cause deaths and injuries and extensive property damage.

The largest earthquakes felt in the United States were along the New Madrid Fault in Missouri, where a three-month long series of quakes from 1811 to 1812 included three quakes larger than a magnitude of 8 on the Richter Scale. These earthquakes were felt over the entire eastern United States, with Missouri, Tennessee, Kentucky, Indiana, Illinois, Ohio, Alabama, Arkansas, and Mississippi experiencing the strongest ground shaking.

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Types

Earthquakes are measured in terms of their magnitude and intensity using the Richter Scale and Modified Mercalli Scale of Earthquake Intensity.

The Richter magnitude scale measures an earthquake's magnitude using an open-ended logarithmic scale that describes the energy release of an earthquake through a measure of shock wave amplitude. The earthquake's magnitude is expressed in whole numbers and decimal fractions. Each whole number increase in magnitude represents a 10-fold increase in measured wave amplitude, or a release of 32 times more energy than the preceding whole number value.

The Modified Mercalli Scale measures the effect of an earthquake on the Earth's surface. Composed of 12 increasing levels of intensity that range from unnoticeable shaking to catastrophic destruction, the scale is designated by Roman numerals. There is no mathematical basis to the scale; rather, it is an arbitrary ranking based on observed events. The lower values of the scale detail the way the earthquake is felt by people, while the increasing values are based on observed structural damage. The intensity values are assigned after gathering responses to questionnaires administered to postmasters in affected areas in the aftermath of the earthquake.

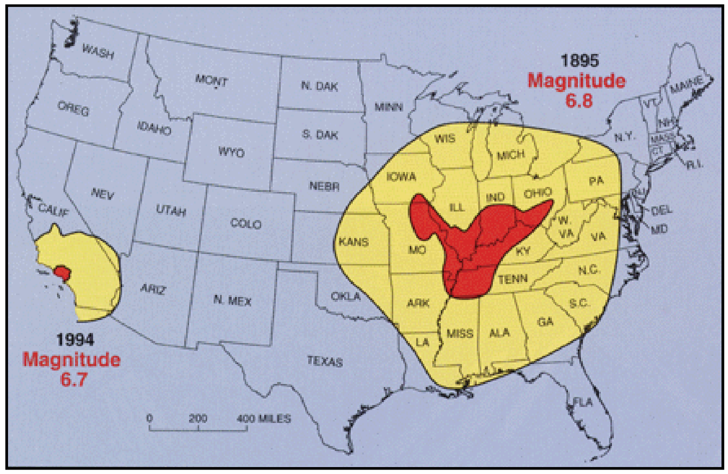
The Modified Mercalli Intensity Scale

Scale	Intensity	Description of Effects	Maximum Acceleration (mm/sec)	Corresponding Richter Scale
I	Instrumental	Detectable only on seismographs	<10	
II	Feeble	Some people feel it	<25	<4.2
III	Slight	Felt by people resting (like a truck rumbling by)	<50	
IV	Moderate	Felt by people walking	<100	
V	Slightly Strong	Sleepers awake; church bells ring	<250	<4.8
VI	Strong	Trees sway; suspended objects swing; objects fall off shelves	<500	<5.4
VII	Very Strong	Mild alarm; walls crack; plaster falls	<1000	<6.1
VIII	Destructive	Moving cars uncontrollable; masonry fractures; poorly constructed buildings damaged	<2500	
IX	Ruinous	Some houses collapse; ground cracks; pipes break open	<5000	<6.9
X	Disastrous	Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread	<7500	<7.3
XI	Very Disastrous	Most buildings and bridges collapse; roads, railways, pipes and cables destroyed; general triggering of other hazards	<9800	<8.1
XII	Catastrophic	Total destruction; trees fall; ground rises and falls in waves	>9800	>8.1

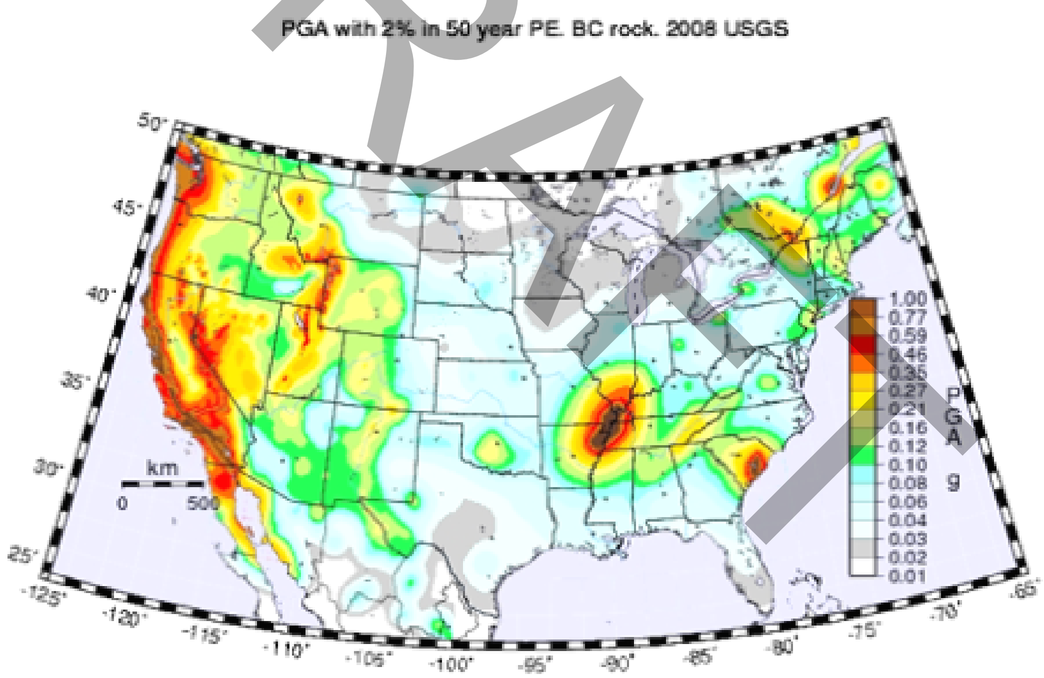
Source: USGS, http://earthquake.usgs.gov/learn/topics/mercalli.php

Facts

Earthquakes in the central or eastern United States affect much larger areas than earthquakes of similar magnitude in the western United States. For example, the San Francisco, California earthquake of 1906 (magnitude 7.8) was felt 350 miles away in the middle of Nevada, whereas the New Madrid earthquake of December 1811 (magnitude 7.7) rang church bells in Boston, Massachusetts, 1,000 miles away. Differences in geology east and west of the Rocky Mountains cause this strong contrast.



Although earthquakes in the central and eastern United States are less frequent than in the western United States, they affect much larger areas. Red on the below map indicates minor to major damage to buildings and their contents. Yellow indicates shaking felt, but little or no damage to objects.



Source: http://earthquake.usgs.gov/hazards/products/

This figure corresponds to the 2008 U.S. Geological Survey National Seismic Hazard Maps. This figure shows a probabilistic ground motion map for Peak Ground Acceleration (PGA), 1Hz (1.0 second SA [spectral accelerations]), and 5Hz (0.2 second SA). Peak ground acceleration tells how hard the earth shakes within the geographic area. This is vital in understanding the impact to structures. The size and magnitude are important, but the PGA will demonstrate expected damages in a finer manner.

The U.S. Geological Survey (USGS) National Seismic Hazard Maps display earthquake ground motions for various probability levels across the United States and are applied in seismic provisions of building codes, insurance rate structures, risk assessments, and other public policy. This update of the maps incorporates new findings on earthquake ground shaking, faults, seismicity, and geodesy. The resulting maps are derived from seismic hazard curves calculated on a grid of sites across the United States that describe the frequency of exceeding a set of ground motions.

Likelihood of Occurrence

The goal of earthquake prediction is to give warning of potentially damaging earthquakes early enough to allow appropriate response to the disaster, enabling people to minimize loss of life and property. The U.S. Geological Survey conducts and supports research on the likelihood of future earthquakes. This research includes field, laboratory, and theoretical investigations of earthquake mechanisms and fault zones. Scientists estimate earthquake probabilities in two ways: by studying the history of large earthquakes in a specific area, and by the rate at which strain accumulates in the rock.

Scientists study the past frequency of large earthquakes in order to determine the future likelihood of similar large shocks. For example, if a region has experienced four magnitude 7 or larger earthquakes during 200 years of recorded history, and if these shocks occurred randomly in time, then scientists would assign a 50 percent probability (that is, just as likely to happen as not to happen) to the occurrence of another magnitude 7 or larger quake in the region during the next 50 years.

Another way to estimate the likelihood of future earthquakes is to study how fast strain accumulates. When plate movements build the strain in rocks to a critical level, like pulling a rubber band too tight, the rocks will suddenly break and slip to a new position. Scientists measure how much strain accumulates along a fault segment each year, how much time has passed since the last earthquake along the segment, and how much strain was released in the last earthquake. This information is then used to calculate the time required for the accumulating strain to build to a level resulting in an earthquake. This simple model is complicated by the fact that such detailed information about faults is rare. In the United States, only the San Andreas fault system has adequate records for using this prediction method.

The University of Memphis estimates that, for a 50-year period, the probability of a repeat of the New Madrid 1811-1812 earthquakes with:

- a magnitude of 7.5 - 8.0 is 7 to 10%
- a magnitude of 6.0 or larger is 25 to 40%

Earthquakes can be experienced in any part of Kentucky, putting Kentucky's entire population and building stock at risk. Each county has at least one fault running beneath it.

4.4.1 Profile: Earthquake

Earthquake Profile Risk Table	
Period of occurrence	Year-round, at any time of the day or the night
Campbell County Number of Events	18 that were recorded felt in Kentucky 216 years (1811 to 2017)
Campbell County Probability of Events	.08
Campbell County Past Damages	Unknown
NKU Number of Events	0
NKU Damages Claimed	$0
Warning Time	Almost non-existent
Potential Impact	Earthquakes can heavily impact human life, health, and public safety. Large events can cause infrastructure damage, utility damage, and critical facilities damage. Secondary events often trigger landslides, dam failure/flooding, and may facilitate the release of hazardous materials from containment structures.
Potential of Injury or Death	The potential this hazard could cause injury or death
Potential Duration of Facility Shutdown	Indefinite
Extent	Year: 1980 Scale: 5.1 Damage: $1,000,000 in Maysville, unknown in NKADD area (50-year probability for New Madrid magnitude of 7.5 - 8.0 is 7 to 10%)

Historical Impacts

Kentucky is affected by earthquakes from several seismic zones in and around the state. The most important one is the **New Madrid Seismic Zone**, in which at least three great earthquakes occurred from December 1811 to February 1812. Because of the infrequency and relatively minor impacts from earthquakes in Campbell County, historical data on occurrences and losses is not available. The table below lists past earthquakes felt in Kentucky, some of which may have been felt in Campbell County, but none caused any recorded damage.

Past Occurrences of Earthquakes felt in Kentucky			
Origin of Earthquake	**Date**	**Magnitude**	**Property Damage**
New Madrid. Missouri	1811 to 1812	Unknown	
Maysville, Kentucky	1828	Unknown	
	11/20/1834	Unknown	
Hickman	12/27/1841	Unknown	
	11/13/1904	Unknown	
	11/25/1904	Unknown	
Mayfield	10/26/1915	Unknown	
Mouth of Ohio River	12/07/1915	Unknown	
Mouth of Ohio River	03/02/1924	Unknown	
Henderson	09/02/1925	Unknown	Chimney Fall

Past Occurrences of Earthquakes felt in Kentucky			
Origin of Earthquake	**Date**	**Magnitude**	**Property Damage**
Middlesboro	01/01/1954	Unknown	
Southern Illinois	11/09/1968	Unknown	Masonry damage
Maysville, Kentucky	07/27/1980	5.1	$1,000,000
Bardwell, Kentucky	06/06/2003	4	
Illinois basin-Ozark dome region	04/18/2008	5.2	
Ottawa, Canada	06/23/2010	5.5	
Greentown, Howard County, IN	12/30/2010	3.8	
Richmond, Virginia	08/23/2011	5.8	
Source: Northern Kentucky 2017 Regional Natural Hazard Mitigation Plan			

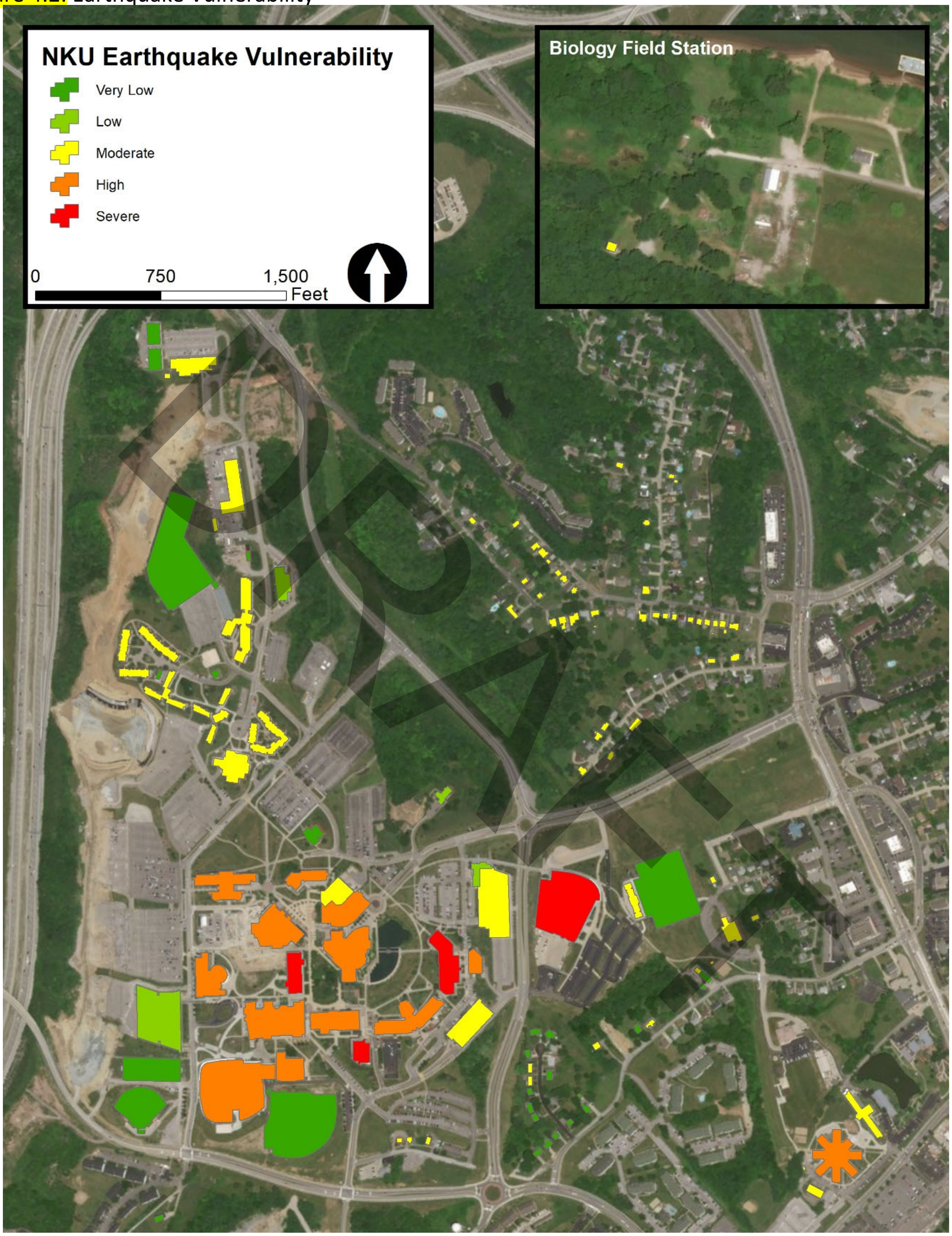
4.4.2 Assessing Vulnerability: Earthquake

Earthquake Vulnerability Score = Hazard Score + Exposure Score

The Earthquake Hazard Score was calculated by combining scores derived from the 2014 USGS 2% chance in 50 years peak ground acceleration (PGA) data and the National Earthquake Hazards Reduction Program (NEHRP) amplification potential data. All NKU buildings and structures are in a moderate earthquake risk area relative to the rest of Kentucky, so they all share the same Earthquake Hazard Score, making the Exposure Score the determining factor in earthquake vulnerability.

The Hazard Score and the Exposure Score were added together and an overall Earthquake Vulnerability Score (0-1) was calculated for each building. The Earthquake Vulnerability Scores are displayed in Figure 4.2.

Figure 4.2: Earthquake Vulnerability



Sources: NKU, Kentucky Geological Survey, United States Geological Survey, ESRI

4.5 Extreme Heat

4.5.1 Identify: Extreme Heat

Extreme high temperatures are responsible for many deaths in the United States each year. Extreme heat has historically affected huge populations. Due to the breadth of occurrence, "on average, excessive heat claims more lives each year than floods, lightning, tornadoes and hurricanes combined" (NOAA).

Excessive heat occurs from a combination of high temperatures (significantly above normal) and high humidity. At certain levels, the human body cannot maintain proper internal temperatures and may experience heat stroke.

These combined elements can manifest medical conditions which are directly attributable to excessive heat exposure:

- ***heat cramps***: Painful muscle cramps and spasms, usually in muscles of legs and abdomen, heavy sweating
- ***heat exhaustion***: Heavy sweating, weakness, cool skin, pale, and clammy. Weak pulse. Normal temperature possible. Possible muscle cramps, dizziness, fainting, nausea, and vomiting.
- ***heat stroke (sunstroke)***: Altered mental state. Possible throbbing headache, confusion, nausea, and dizziness. High body temperature (106°F or higher). Rapid and strong pulse. Possible unconsciousness. Skin may be hot and dry, or patient may be sweating. Sweating likely especially if patient was previously involved in vigorous activity.

Heat Index
The "Heat Index" is a measure of the effect of the combined elements of heat and humidity on the body. A temperature as low as 80°F and a relative humidity of 40% is significant in that it ranks at the "caution" level of the NOAA's Apparent Temperature chart – also known as the heat index.

NOAA's National Weather Service

Heat Index

Temperature (°F)

Relative Humidity (%)	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution | Extreme Caution | Danger | Extreme Danger

It is important to note that these heat index values were devised for shady, light wind conditions. Exposure to full sunshine can increase heat index values by up to 15°F.

Matching the possible medical conditions with the four-element scale of the heat index above is critical to understanding the likelihood of impacts from exposure:

- ***Extreme Danger***: Heat stroke or sunstroke likely.
- ***Danger***: Sunstroke, muscle cramps, and/or heat exhaustion likely. Heatstroke possible with prolonged exposure and/or physical activity.
- ***Extreme Caution***: Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity.
- ***Caution***: Fatigue possible with prolonged exposure and/or physical activity.

NOAA's Watch, Warning, and Advisory Products for Extreme Heat

Each NWS Weather Forecast Office can issue the following heat-related products as conditions warrant:

- ***Excessive Heat Outlook***: are issued when the potential exists for an excessive heat event in the next 3-7 days. An Outlook provides information to those who need considerable lead time to prepare for the event, such as public utilities, emergency management, and public health officials.
- ***Excessive Heat Watch***: is issued when conditions are favorable for an excessive heat event in the next 12 to 48 hours. A Watch is used when the risk of a heat wave has increased, but its occurrence and timing is still uncertain. A Watch provides enough lead time so those who need to prepare can do so, such as cities that have excessive heat event mitigation plans.
- ***Excessive Heat Warning/Advisory*** is issued when an excessive heat event is expected in the next 36 hours. These products are issued when an excessive heat event is occurring, is imminent, or has a very high probability of occurring. The warning is used for conditions posing a threat to life or property. An advisory is for less serious conditions that cause significant discomfort or inconvenience and, if caution is not taken, could lead to a threat to life and/or property.

The EPA has also developed a guidebook on excessive heat events (EHE) that has two basic goals:

1. to provide local health and public safety officials with the information they need to develop EHE criteria and evaluate the potential health impacts of EHEs
2. to offer a menu of EHE notification and response actions to be considered

4.5.2 Profile: Extreme Heat

Extreme Heat Profile Risk Table	
Period of occurrence	May through October
Campbell County Number of Events	5 (recorded by NCEI) 21 years (1996-2017)
Campbell County Probability of Events	.24
Campbell County Past Damages	$0 recorded
NKU Number of Events	5
NKU Damages Claimed	$0
Warning Time	Days to a week
Potential Impact	Main impacts are to public health and safety, especially the elderly. Heavy use of utilities (electric and water) causes a strain on energy systems resulting from increased air conditioner, fan, and water usage. Economic losses due to 'stay-indoor warnings' that prevent people from going to work are possible.
Potential of Injury or Death	Slight chance of injury and risk of deaths in children and elderly
Potential Duration of Facility Shutdown	Days to months
Extent	Temperature over 100 degrees and one heat related death in nearby Boone County in July 1999.

Historical Impacts
Records for extreme heat events are limited, with only a few recorded events for Campbell County. While other events may have occurred, the events described here represent best available data from the NCEI Storm Events Database. NKU has no records of extreme heat events.

Since the NCEI began tracking excessive heat events in 1996, there have been 5 recorded heat events in Campbell County. Because heat is not contained in a specific location, it is assumed the Campbell County events had a similar impact on the NKU campus.

1999 - Most of northern Kentucky experienced a heat wave in July 1999. Over the last half of the month, nearly every day experienced temperatures above 90 degrees, with a few going over 100. There was one heat related death in nearby Boone County.

2007 -. From August 7 through August 10, 2007, northern Kentucky experienced oppressively hot and humid conditions. Most days saw the heat index reach 105 degrees. Later in August, the 23rd and 24th northern Kentucky experienced a heat index near 105 degrees.

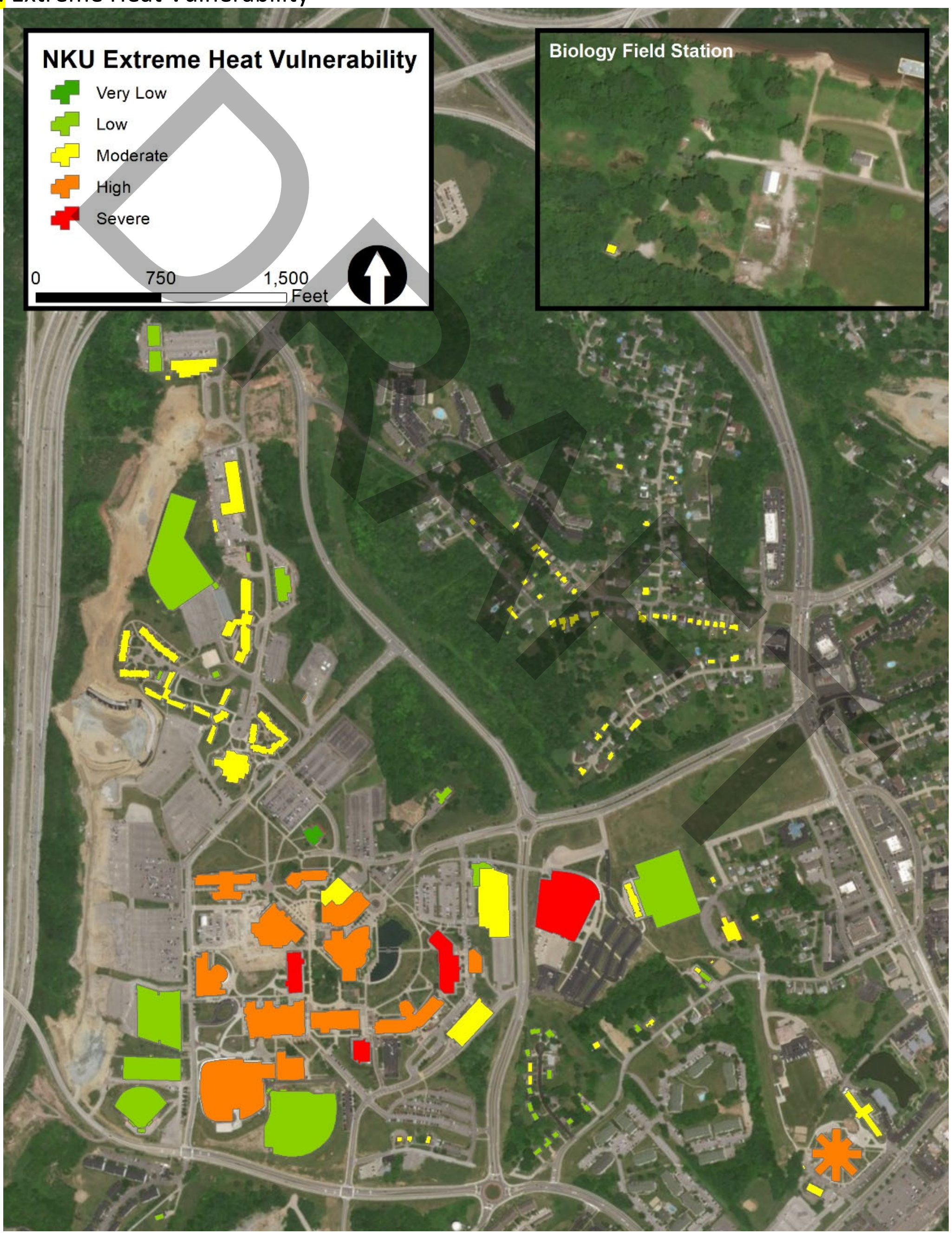
2012 - In late June 2012 a very warm airmass entered the northern Kentucky region that brought a prolonged period for record heat and dangerous heat indices. The heat index exceeded 101 degrees on June 28, 109 on June 29, and 99 on June 30. This heat wave continued into July, with heat indices ranging from 95 to 105 degrees each day through August 7.

4.5.3 Assessing Vulnerability: Extreme Heat

Extreme Heat Vulnerability Score = Hazard Score + Exposure Score

Variations in Extreme Heat are difficult to identify at the county level, and even more difficult at the campus level. Because Extreme Heat is assumed to impact all NKU buildings and structures equally, the Extreme Heat Hazard Score is assumed to be the same for all university buildings. Therefore, the Exposure Score represents the Extreme Heat Vulnerability Score.

Table 4.3: Extreme Heat Vulnerability



Sources: NKU Facilities Management, NKU Office of the Comptroller, NKU Campus Planning, ESRI

4.6 Extreme Cold

4.6.1 Identify: Extreme Cold

What constitutes extreme cold and its effect varies across different areas of the United States. In areas unaccustomed to winter weather, near freezing temperatures are considered "extreme cold." In the north, below zero temperatures may be considered as "extreme cold." Extreme cold often accompanies a winter storm or is left in its wake.

Whenever temperatures drop decidedly below normal and as wind speed increases, heat can leave your body more rapidly. These weather-related conditions may lead to serious health problems. Extreme cold is a dangerous situation that can bring on health emergencies in susceptible people, such as those without shelter or who are stranded, or who live in a home that is poorly insulated or without heat. Prolonged exposure to the cold can cause frostbite or hypothermia and become life-threatening. Infants and elderly people are most susceptible.

Freezing temperatures can also cause severe damage to citrus fruit crops and other vegetation. Pipes may freeze and burst in homes that are poorly insulated or without heat. Long cold spells can cause rivers to freeze, disrupting shipping. Ice jams may form and lead to flooding.

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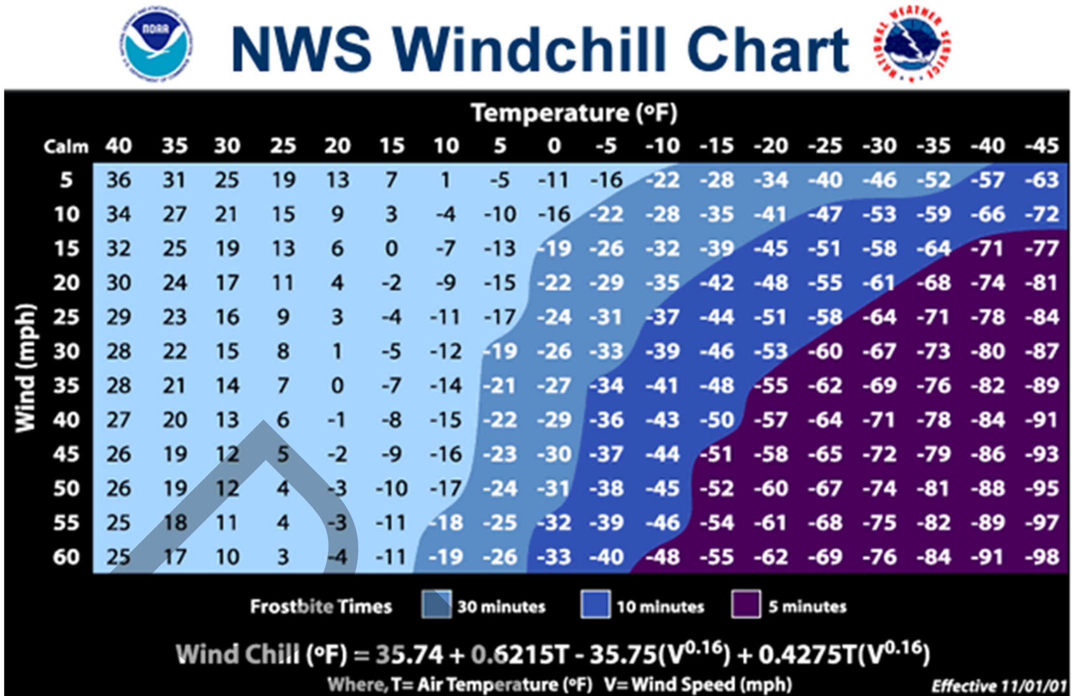
NOAA's National Weather Service wind chill chart shows the increasing dangers as temperature drops and wind speed increases. In cold winter months, National Weather Service weather forecast offices routinely issue two types of alerts to warn people about dangerously low wind chill temperatures.

- A *Wind Chill Advisory* is issued when wind chill temperatures are potentially hazardous.
- A *Wind Chill Warning* is issued when wind chill temperatures are life threatening.

However, temperature criteria for an advisory or warning can vary from state to state to reflect regional climate differences.



NWS Windchill Chart

Wind (mph) \ Temperature (°F)	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

Wind Chill (°F) $= 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$

Where, T= Air Temperature (°F) V= Wind Speed (mph) Effective 11/01/01

Source: NOAA/NWS, http://www.nws.noaa.gov/om/windchill/

4.6.2 Profile: Extreme Cold

Extreme Cold Profile Risk Table	
Period of occurrence	October through April
Campbell County Number of Events	2 (Recorded by NCEI) 21 years (1996-2017)
Campbell County Probability of Events	.09
Campbell County Past Damages	Recorded Losses - $485,000 Annualized Losses - $23,095
NKU Number of Events	2
NKU Damages Claimed	Recorded Losses - $26,153 Annualized Losses - $6,538
Warning Time	Days to a week
Potential Impact	Extreme cold, impacts human life, health, and public safety. Rivers and lakes freeze causing transportation issues. Energy consumption goes up and depending on the time of year extreme cold can have large impacts on agriculture. Cold temperatures can also cause ruptured pipes and stressed on engines and motors.
Potential of Injury or Death	Slight chance of injury and risk of deaths in children and elderly
Potential Duration of Facility Shutdown	Days to months
Extent	1996, 11 below zero coldest temperature, property damage

Historical Impacts
Records for extreme cold events are limited, with only a few recorded events for Campbell County and NKU. While other events may have occurred, the events described here represent best available data from the NCEI Storm Events Database and from NKU records.

1996 – In February of 1996 Arctic high pressure brought very cold air to northern Kentucky. The Greater Cincinnati/Northern Kentucky Airport recorded the lowest temperature ever on February 4, at 11 degrees below zero. The airport set records for the lowest maximum temperature at 7 degrees on the 3rd and followed that with 6 degrees in the 4th. The cold spell lasted five days and resulted in an estimated $20,000 of property damage in Campbell County.

2007 – March 2007 experienced unseasonably warm temperatures that resulted in early agricultural production on northern Kentucky. Unfortunately, April brought a cold spell with temperatures dropping into the twenties, causing an estimated $465,000 of crop damage in Campbell County.

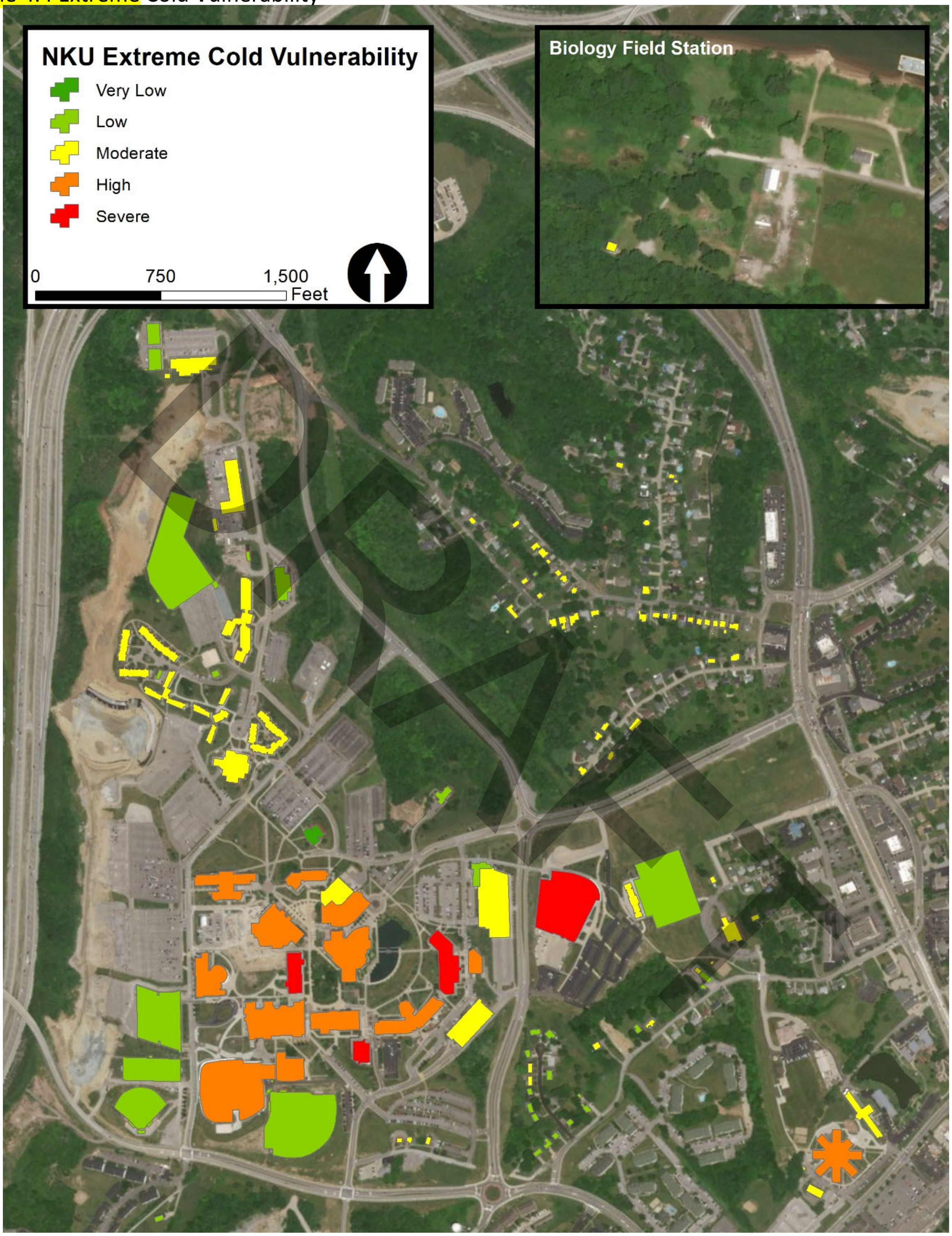
2017 – Cold temperatures in January and February caused two separate incidents of frozen pipes bursting resulting in over $26,000 in property damage to Norse Hall and University Suites on the NKU campus.

4.6.3 Assessing Vulnerability: Extreme Cold

Extreme Cold Vulnerability Score = Hazard Score + Exposure Score

Variations in Extreme Cold are difficult to identify at the county level, and even more difficult at the campus level. Because Extreme Cold is assumed to impact all NKU buildings and structures equally, the Extreme Cold Hazard Score is assumed to be the same for all University buildings. Therefore, the Exposure Score represents the Extreme Cold Vulnerability Score.

Table 4.4 Extreme Cold Vulnerability



Sources: NKU Facilities Management, NKU Office of the Comptroller, NKU Campus Planning, ESRI

4.7 Flood

4.7.1 Identify: Flood

A flood is a natural event for rivers and streams and is caused in a variety of ways. Winter or spring rains, coupled with melting snows, can fill river basins too quickly. Torrential rains from decaying hurricanes or other tropical systems can also produce flooding. The excess water from snowmelt, rainfall, or storm surge accumulates and overflows onto the banks and adjacent floodplains. Floodplains are lowlands, adjacent to rivers, lakes, and oceans that are subject to recurring floods. Currently, floodplains in the U.S. are home to over nine million households.

A flood, as defined by the NFIP is a general and temporary condition of partial or complete inundation of two or more acres of normally dry land area, or of two or more properties from:

- overflow of inland or tidal waters
- unusual and rapid accumulation or runoff of surface waters from any source
- a mudflow
- a collapse or subsidence of land along the shore of a lake or similar body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels that result in a flood

Factors determining the severity of floods include:

- Rainfall intensity and duration
- A large amount of rain over a short time can result in flash flooding
- Small amounts may cause flooding where the soil is saturated
- Small amounts may cause flooding if concentrated in an area of impermeable surfaces
- Topography and ground cover
- Water runoff is greater in areas with steep slopes and little vegetation

Frequency of inundation depends on the climate, soil, and channel slope. In regions without extended periods of below-freezing temperatures, floods usually occur in the season of highest precipitation.

Types

Floods are the result of a multitude of naturally occurring and human-induced factors, but they all can be defined as the accumulation of too much water in too little time in a specific area. Types of floods include regional floods, river or riverine floods, flashfloods, urban floods, ice-jam floods, storm-surge floods, dam- and levee-failure floods, and debris, landslide, and mudflow floods. The following information is specific to the mid-west, especially, Kentucky:

- *Regional Flooding* can occur seasonally when winter or spring rains coupled with melting snow fill river basins with too much water too quickly. The ground may be frozen, reducing infiltration into the soil and thereby increasing runoff. Extended wet periods during any part of the year can create saturated soil conditions, after which any additional rain runs off into streams and rivers, until river capacities are exceeded. Regional floods are many times associated with slow-moving, low-pressure or frontal storm systems including decaying hurricanes or tropical storms.
- *River* or *Riverine Flooding* is a high flow or overflow of water from a river or similar body of water, occurring over a period too long to be considered a flash flood.

- *Flash Floods* are quick-rising floods that usually occur as the result of heavy rains over a short period of time, often only several hours or even less. Flash floods can occur within several seconds to several hours and with little warning. They can be deadly because they produce rapid rises in water levels and have devastating flow velocities.
- Several factors can contribute to flash flooding. Among these are rainfall intensity, rainfall duration, surface conditions, and topography and slope of the receiving basin. Urban areas are susceptible to flash floods because a high percentage of the surface area is composed of impervious streets, roofs, and parking lots where runoff occurs very rapidly. Mountainous areas also are susceptible to flash floods, as steep topography may funnel runoff into a narrow canyon. Floodwaters accelerated by steep stream slopes can cause the flood-wave to move downstream too fast to allow escape, resulting in many deaths.

- Flash floods can also be caused by ice jams on rivers in conjunction with a winter or spring thaw, or occasionally even a dam break. The constant influx of water finally causes a treacherous overflow; powerful enough to sweep vehicles away, roll boulders into roadways, uproot trees, level buildings, and drag bridges off their piers.

- *Urban Flooding* is possible when land is converted from fields or woodlands to roads and parking lots; thus, losing its ability to absorb rainfall. Urbanization of a watershed changes the hydrologic systems of the basin. Heavy rainfall collects and flows faster on impervious concrete and asphalt surfaces. The water moves from the clouds, to the ground, and into streams at a much faster rate in urban areas. Adding these elements to the hydrological systems can result in floodwaters that rise very rapidly and peak with violent force. During periods of urban flooding, streets can become swift moving rivers and basements can fill with water. Storm drains often back up with vegetative debris causing additional, localized flooding.

- *Dam-Failure Flooding* is potentially the worst flood event. A dam failure is usually the result of neglect, poor design, or structural damage caused by a major event such as an earthquake. When a dam fails, an access amount of water is suddenly let loose downstream, destroying anything in its path. Dams and levees are built for flood protection. They usually are engineered to withstand a flood with computed risk of occurrence. For example, a dam or levee may be designed to contain a flood at a location on a stream that has a certain probability of occurring in any one year. If a larger flood occurs, then that structure will be overtopped. If during the overtopping the dam or levee fails or is washed out, the water behind it is released and becomes a flash flood. Failed dams or levees can create floods that are catastrophic to life and property because of the tremendous energy of the released water.

- *Debris, Landslide, and Mudflow Flooding* is created by the accumulation of debris, mud, rocks, and/or logs in a channel, forming a temporary dam. Flooding occurs upstream as water becomes stored behind the temporary dam and then becomes a flash flood when the dam is breached and rapidly washes away. Landslides can create large waves on lakes or embankments and can be deadly.

- Most lives are lost when people are swept away by flood currents, whereas most property damage results from inundation by sediment-laden water. Flood currents also possess tremendous destructive power as lateral forces can demolish buildings and erosion can undermine bridge foundations and footings leading to the collapse of structures.

Facts

The community should be informed that:

- 80% of flood deaths occur in vehicles, and most happen when drivers try to navigate through flood waters.
- Only six inches of rapidly moving flood water can knock a person down.
- A mere two feet of water can float a large vehicle.
- One-third of flooded roads and bridges are so damaged by water that any vehicle trying to cross stands only a 50% chance of making it to the other side.
- 95% of those killed in a flash flood tried to outrun the waters along their path rather than climbing rocks or going uphill to higher grounds.
- Most flood-related deaths are due to flash floods.
- Homeowners' insurance policies do not cover floodwater damage.
- Six to eight million homes are located in flood-prone areas.
- Flooding has caused the deaths of more than 10,000 people since 1900.
- More than $4 billion is spent on flood damage in the U.S. each year.
- On average, there are about 145 deaths each year due to flooding.
- About one-third of insurance claims for flood damages are for properties located outside identified flood hazard areas.
- Under normal conditions floods do not cause damage. Damage occurs when structures are built in flood-prone areas.

Common Flood-Related Terms

- *100-Year Flood Plain*. The area that has a 1% chance, on average, of flooding in any given year. (Also known as the Base Flood.)
- *500-Year Flood Plain*. The area that has a 0.2% chance, on average, of flooding in any given year.
- *Base Flood*. Represents a compromise between minor floods and the greatest flood likely to occur in a given area. The elevation of water surface resulting from a flood that has a 1% chance of occurring in any given year.
- *Floodplain*. The land area adjacent to a river, stream, lake, estuary, or other water body that is subject to flooding. This area, if left undisturbed, acts to store excess floodwater. The floodplain is made up of two sections: the floodway and the flood fringe.
- *Floodway*. The NFIP floodway definition is "the channel of a river or other watercourse and adjacent land areas that must be reserved, in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot." The floodway carries the bulk of the floodwater downstream and is usually the area where water velocities and forces are the greatest. NFIP regulations require that the floodway be kept open and free from development or other structures that would obstruct or divert flood flows onto other properties. Floodways are not mapped for all rivers and streams but are generally mapped in developed areas. Unlike floodplains, floodways do not reflect a recognizable geologic feature.
- *Flood Fringe*. The flood fringe refers to the outer portions of the floodplain, beginning at the edge of the floodway and continuing outward. The fringe land area is outside of the stream or river floodway but is subject to inundation by regular flooding.

4.7.2 Profile: Flood

Flood Profile Risk Table	
Period of occurrence	Year-round
Campbell County Number of Events	50 (Recorded by NCEI) 21 years (1996-2017)
Campbell County Probability of Events	2.38
Campbell County Past Damages	Recorded Losses - $286,000 + $1,118,131.10 in Repetitive Loss and Severe Repetitive Loss (Northern Kentucky 2017 Regional Natural Hazard Mitigation Plan) Annualized Losses - $66,863
NKU Number of Events	0
NKU Damages Claimed	$0
Warning Time	River flooding - 3 to 5 days Flash flooding - minutes to several hours
Potential Impact	Impacts human life, health, and public safety. Utility damages and outages, infrastructure damage (transportation and communication systems), structural damage, fire, damaged or destroyed critical facilities, and hazardous material releases. Can lead to economic losses such as unemployment, decreased land values, and agribusiness losses. Floodwaters are a public safety issue due to contaminants and pollutants.
Potential of Injury or Death	Injury and risk of multiple deaths
Potential Duration of Facility Shutdown	Weeks to months
Extent	Flood 7/4/2013 $50,000 in Damages, 0 deaths, 0 injuries

Historical Impacts

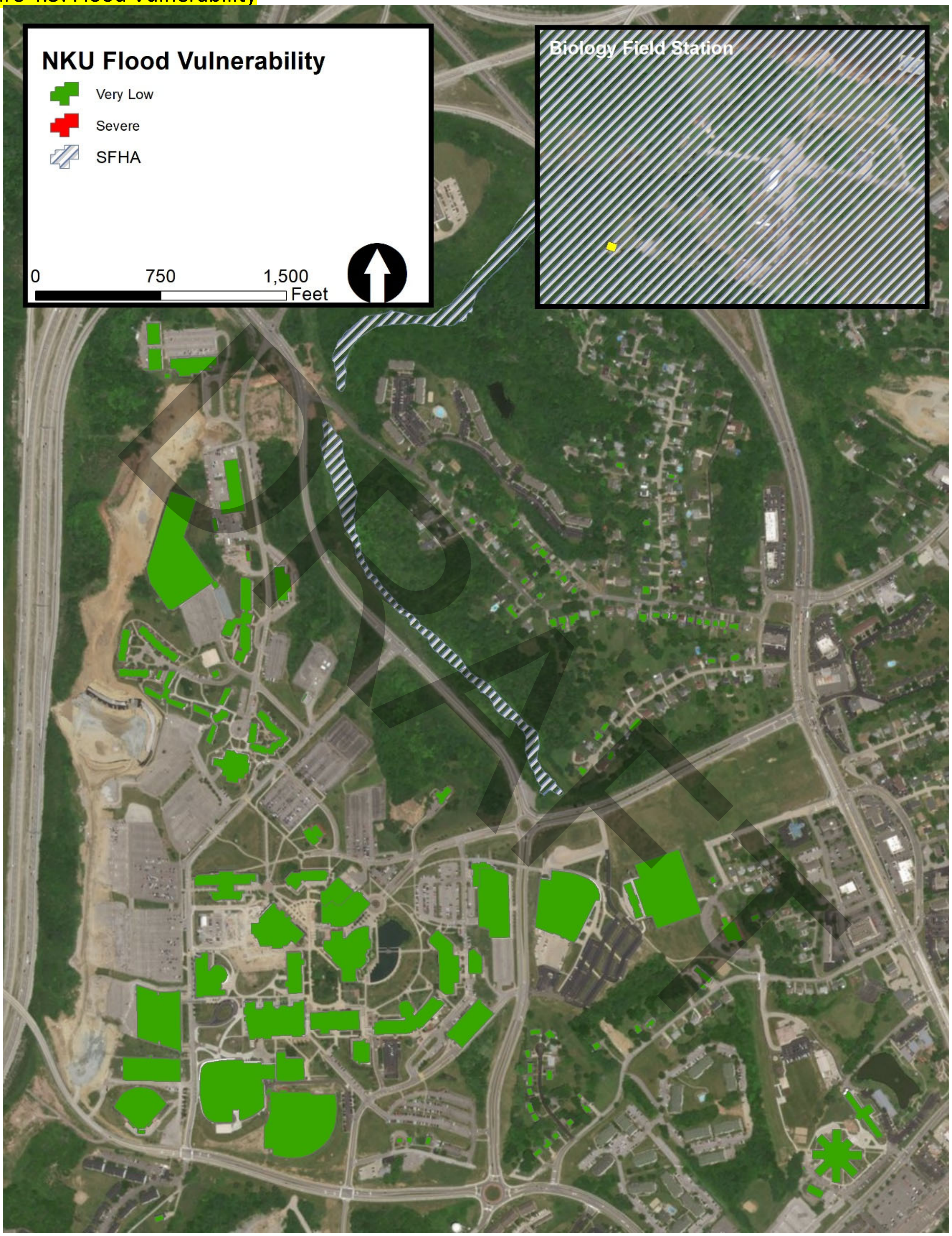
NKU does not have any record of flood events impacting university property. Buildings have experienced water damage from broken pipes or malfunctioning drains, but none of the events were actual floods. A small portion of the main campus is in the 1% annual chance floodplain, however there are no university buildings or structures on the main campus located in the floodplain. The Biology Field Station, located off-campus near the Ohio River, is located within the 1% annual chance floodplain, but the university does not have records of flood damage to the building.

4.7.3 Assessing Vulnerability: Flood

Flood Vulnerability Score = Exposure Score + Hazard Score

The Flood Vulnerability Score was calculated by combining the Exposure Score and the Hazard Score. The Flood Hazard score was calculated using the geographic extent of the 1% annual chance floodplain. Areas within the floodplain received a score of 1 and those outside received a score of 0. The Flood Hazard Score was added to the Exposure Score and the sum was rescored on a 0 to 1 scale, resulting in the Flood Vulnerability Score. Buildings and structures located outside the floodplain have a flood vulnerability score of 0.

Figure 4.5: Flood Vulnerability



Sources: NKU, FEMA, ESRI

4.8 Hail

4.8.1 Identify: Hail

Hail is showery precipitation in the form of irregular pellets or balls of ice more than 5 mm in diameter, falling from a cumulonimbus cloud (NOAA Glossary).

Hail is a somewhat frequent occurrence associated with severe thunderstorms. Hailstones grow as ice pellets and are lifted by updrafts and collect super-cooled water droplets. As they grow, hailstones become heavier and begin to fall. Sometimes, they are caught by successively stronger updrafts and are re-circulated through the cloud growing larger each time the cycle is repeated. Eventually, the updrafts can no longer support the weight of the hailstones. As hailstones fall to the ground, they produce a hail-streak (i.e. area where hail falls) that may be more than a mile wide and a few miles long.

Types
Hail is a unique and common hazard capable of producing extensive damage from the impact of these falling objects. Hailstorms occur more frequently during the late spring and early summer months. Most thunderstorms do not produce hail, and ones that do normally produce only small hailstones not more than one-half inch in diameter. However, hailstones can grow larger than the size of a golf ball before falling to the ground.

Facts

- Hailstones can fall at speeds of up to 120 mph.
- Hail is responsible for nearly $1 billion in damage to crops and property each year in the U.S.
- The largest hailstone ever recorded fell in Vivian, South Dakota in 2010. It measured 8 inches in diameter and weighed almost two pounds.

TORRO Hail Intensity Scale
Intensity categories range from H0 to H10, with H10 being the most destructive indicating structural damage possible.

TORRO Hailstorm Intensity Scale				
	Intensity Category	**Typical Hail Diameter (mm)***	**Probable Kinetic Energy, J-m2**	**Typical Damage Impacts**
H0	Hard Hail	5	0-20	No damage
H1	Potentially Damaging	5 - 15	>20	Slight general damage to plants, crops
H2	Significant	10 - 20	>100	Significant damage to fruit, crops, vegetation
H3	Severe	20-30	>300	Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored
H4	Severe	25-40	>500	Widespread glass damage, vehicle bodywork damage
H5	Destructive	30-50	>800	Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries
H6	Destructive	40-60		Bodywork of grounded aircraft dented, brick walls pitted

TORRO Hailstorm Intensity Scale				
	Intensity Category	Typical Hail Diameter (mm)*	Probable Kinetic Energy, J-m2	Typical Damage Impacts
H7	Destructive	50-75		Severe roof damage, risk of serious injuries
H8	Destructive	60-90		Severe damage to aircraft bodywork
H9	Super Hailstorms	75-100		Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open
H10	Super Hailstorms	>100		Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open

4.8.2 Profile: Hail

Hail Profile Risk Table	
Period of occurrence	Year-round
Campbell County Number of Events	48 (Recorded by NCEI) 55 years (1962-2017)
Campbell County Probability of Events	.87
Campbell County Past Damages	Recorded Losses: $10,000 Annualized Losses: $182
NKU Number of Events	0
NKU Damages Claimed	$0
Warning Time	Predicting hail is difficult. Most advance warning comes from knowledge of conditions present that could produce hail; it is minutes to an hour at best.
Potential Impact	Impacts to human life, health and public safety are possible. Utility damage and failure, infrastructure damage, structural damage, fire, damaged or destroyed critical facilities, and hazardous material releases are additional impacts.
Potential of Injury or Death	Injury and slight chance of deaths
Potential Duration of Facility Shutdown	Days
Extent	6/23/2016 - Size: 1.75 inches in Highland Heights

Historical Impacts

NKU does not have records of any hail damage on campus. Because may occur across a wide area, hail occurrences from Campbell County are described here.

2003 – On May 1, Campbell County experienced hail .75 inch in diameter resulting in $2,000 in reported damages.

2007 – Campbell County experience 4 different hail events in 2007 with $7,000 in reported damage.

2009 – On May 30, Campbell County experienced hail .75 inch in diameter resulting in $1,000 in reported damages. This storm also produced two tornadoes.

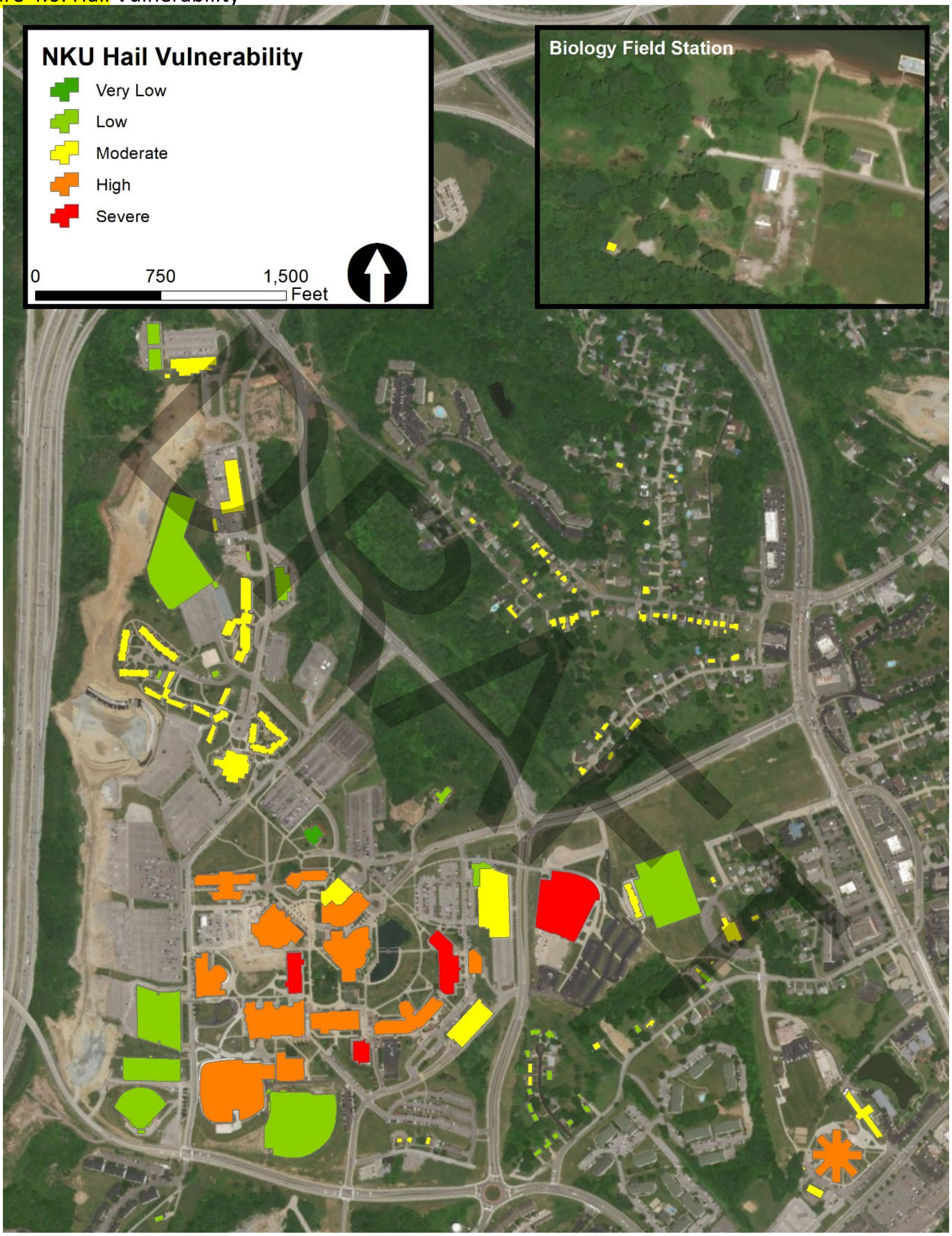
In total, Campbell County experienced 48 hail events from 1962 through 2017, with hail ranging in size from .75 inch to 2.5 inches.

4.8.3 Assessing Vulnerability:

Hail Vulnerability Score = Hazard Score + Exposure Score

Variations in hail occurrences are difficult to identify at the county level, and even more difficult at the campus level. Because hail is assumed to impact all NKU buildings and structures equally and the university does not have occurrence data, the Hail Hazard Score is assumed to be the same for all university buildings. Therefore, the Exposure Score represents the Hail Vulnerability Score.

Figure 4.6: Hail Vulnerability



Sources: NKU, NCEI, ESRI

4.9 HazMat

4.9.1 Identify: HazMat

A hazardous material (HazMat) is a dangerous or potentially harmful substance that will impact human health or the environment. Hazardous materials can be found in the form of liquids, solids, or gasses. A HazMat release can range in impact by the very nature of the diversity of products in existence that are hazardous to humans. This hazard is not just a direct impact on health but can also cause secondary impacts in the form of making daily activities hazardous. An example of this would be a lubricant, such as hydraulic fluid, spill causing slick road conditions resulting in vehicular accidents. Hazardous materials generally fall into one of the following categories: chemical, biological, radiological, or nuclear. These four groups are known collectively as CBRNs.

The small capability for handling these types of events by the general public leads these events to be greatly dangerous and possibly deadly. Unlike a flood or winter storm, that generally has a warning time associated with it that allows citizens to escape safely from an event with a planned evacuation, HazMat releases do not follow this trend. They happen suddenly due to an infrastructure failure, facilities failure, or transportation accident. They are also usually very capable of initially being airborne due to an explosion or become airborne shortly after releasing due to interactions and fire. The airborne nature of many HazMat spills and the possibility of Toxic Inhalation Hazard (TIH) exposure makes this hazard unique to other hazards due to a reliance on special equipment when responding. In a case that the general population does not have access to Personal Protective Equipment (PPE) that would be vital for surviving a HazMat release, the damage to the population could be extensive.

For the reasons outlined above, it is imperative for the officials to respond quickly and efficiently to these types of hazards when they occur. The first reference guide that should be utilized by HazMat Teams is the 2016 Emergency Response Guidebook. This is “A Guidebook for First Responders during the Initial Phase of a Dangerous Goods/ Hazardous Materials Transportation Incident.”

4.9.2 Profile: HazMat

HazMat Profile Risk Table	
Period of occurrence	Year-round
Campbell County Number of Events	7 (Recorded by PHMSA)[1] 46 years (1971-2017)
Campbell County Probability of Events	.15
Campbell County Past Damages	$61,573
NKU Number of Events	0
NKU Damages Claimed	$0
Warning Time	None
Potential Impact	Utility damage and outages, infrastructure damage (transportation and communication systems), structural damage, fire, damaged or destroyed critical facilities, and hazardous material releases.
Potential of Injury or Death	Injury and risk of multiple deaths
Potential Duration of Facility Shutdown	Days to Months
Extent	8500 liquid gallons (LGA) of gasoline spilled on I-275 at Route 9 on 12/11/1993. Reported damages = $40,609

Historical Impacts

The most common occurrences of hazardous material leaks involve gas line breaks that supply homes with natural gas for heating and cooking. Gasoline tanks below ground at refueling stations also pose a risk of leakage and water contamination. Roadways and railways are also common places where HazMat incidents occur.

NKU does not have any recorded HazMat incidents, however because the campus is located near a railway and an interstate highway, HazMat incidents are a concern. Seven HazMat incidents are recorded for Campbell County in the Pipeline and Hazardous Materials Safety Administration's Hazardous Materials Incident Database.

[1] Pipeline and Hazardous Materials Safety Administration, https://www.phmsa.dot.gov/hazmat-program-management-data-and-statistics/data-operations/incident-statistics

HazMat Incidents							
Date	**Incident Route**	**Transportation Phase**	**Commodity Short Name**	**Hazardous Class**	**Quantity Released**	**Unit of Measure**	**Total Amount of Damages**
9/29/1989	I-471 Exit 3	In Transit	Naphtha Petroleum	Combustible Liquid	330	LGA	9300
12/13/1991	State Route 9	Unloading	Fuel Oil No. 1 2 4 5	Combustible Liquid	10	LGA	7
5/28/1993	9th & Lowell St	Unloading	Orm-B N.O.S.	Miscellaneous Hazardous Material	1	LGA	0
12/11/1993	I-275 & Rt 9	In Transit	Gasoline Includes Gasoline	Flammable - Combustible Liquid	8510	LGA	40609
4/25/1995	Ninth And Lowell	N/A	Hazardous Waste Solid	Miscellaneous Hazardous Material	6300	SLB	4000
10/29/1997	Highway 9 (Aa Highway)	In Transit	Adhesives Containing A	Flammable - Combustible Liquid	5	LGA	3600
8/8/2002	724 Covert Run Pike Lot 9	Unloading	Petroleum Gases Liquefied	Flammable Gas	80	LGA	4057
LGA = liquid gallon, SLB = solid pound							
Source: Pipeline and Hazardous Materials Safety Administration's Hazardous Materials Incident Database							

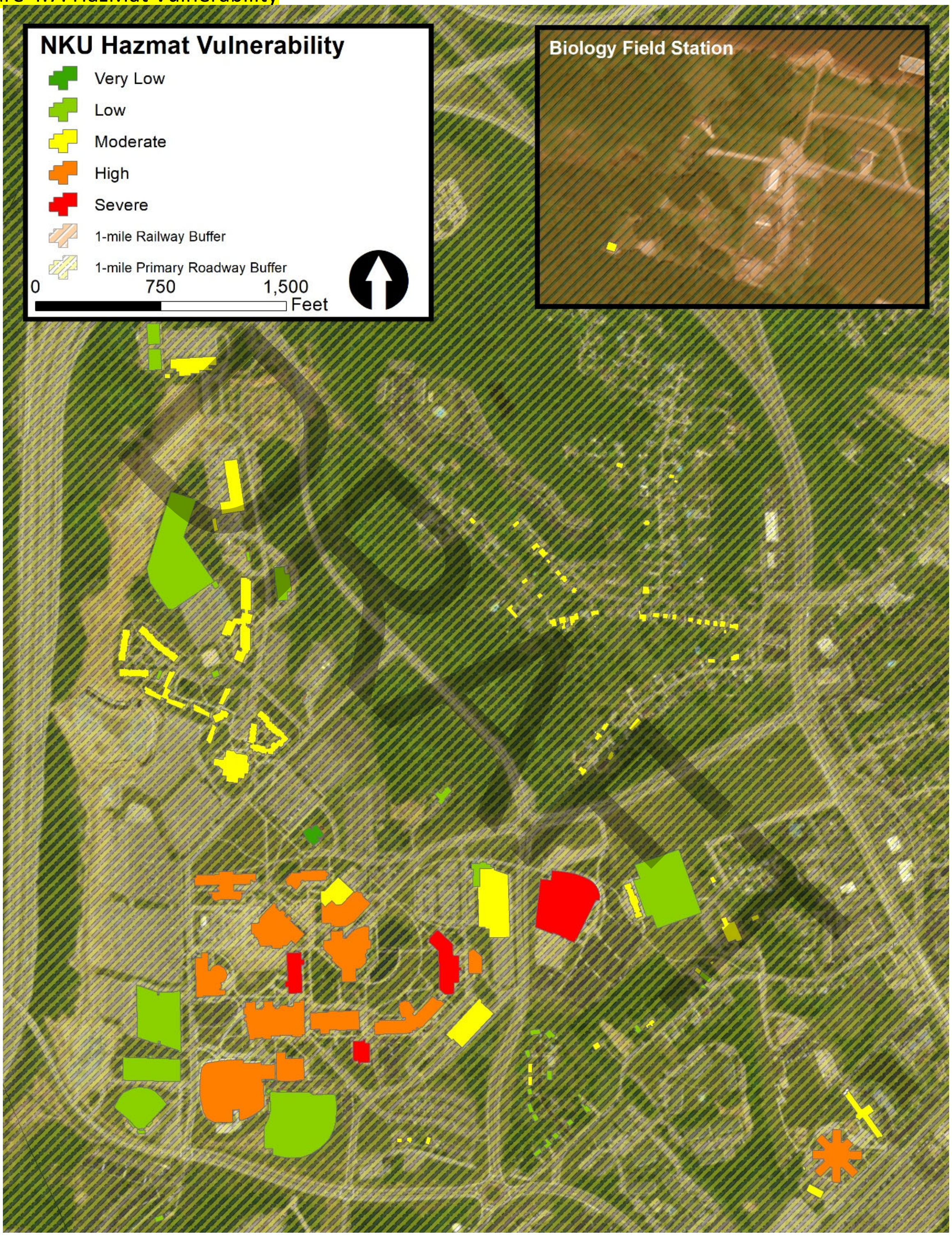
4.9.3 Assessing Vulnerability: HazMat

HazMat Vulnerability Score = Exposure Score + Hazard Score

The HazMat Hazard Score was calculated by creating 1-mile buffer areas around railways, interstates, and major arterials. All the main campus is within the 1-mile buffer of I-275 and US 27. The Biology Field Station is within the 1-mile buffer area of the CSX railway. Because all NKU buildings/structures are within a 1-mile buffer of either a highway or railway, they all have the same HazMat Hazard Score, making the Exposure Score the determining factor in HazMat vulnerability.

The Hazard Score and the Exposure Score were added together and an overall HazMat Vulnerability Score (0-1) was calculated for each building. The HazMat Vulnerability Scores are displayed in Figure 4.7.

Figure 4.7: HazMat Vulnerability



Sources: NKU, US Census Bureau, ESRI

4.10 Karst/Sinkhole

4.10.1 Identify: Karst/Sinkhole

Karst is a terrain, generally underlain by limestone or dolomite, in which the topography is chiefly formed by the dissolving of rock and which may be characterized by sinkholes, sinking streams, closed depressions, subterranean drainage, and caves (Kentucky Geological Survey).

Karst refers to a type of topography formed in limestone, dolomite, or gypsum by dissolution of these rocks by rain and underground water. It is characterized by closed depressions or sinkholes and underground drainage. During the formation of Karst terrain, water percolating underground enlarges subsurface flow paths by dissolving the rock. As some subsurface flow paths are enlarged over time, water movement in the aquifer changes character from one where ground water flow was initially through small, scattered openings in the rock, to one where most flow is concentrated in a few, well-developed conduits. As the flow paths continue to enlarge, caves may be formed, and the ground water table may drop below the level of surface streams. Surface streams may then begin to lose water to the subsurface. As more of the surface water is diverted underground, surface streams and stream valleys become a less conspicuous feature of the land surface and are replaced by closed basins. Funnels or circular depressions called sinkholes often develop at some places in the low points of these closed basins.

Karst Landscape
A karst landscape has sinkholes, sinking streams, caves, and springs. The term "karst" is derived from a Slavic word that means barren, stony ground. It is also the name of a region in Slovenia near the border with Italy that is well known for its sinkholes and springs. Geologists have adopted karst as the term for all such terrain. The term "karst" describes the whole landscape, not a single sinkhole or spring.

A karst landscape most commonly develops on limestone, but can develop on several other types of rocks, such as dolostone (magnesium carbonate or the mineral dolomite), gypsum, and salt. Precipitation infiltrates into the soil and flows into the subsurface from higher elevations and generally toward a stream at a lower elevation. Weak acids found naturally in rain and soil water slowly dissolve the tiny fractures in the soluble bedrock, enlarging the joints and bedding planes.

Fifty-five percent of Kentucky sits atop carbonate rocks that are prone to developing karst. Karst hazards include sinkhole flooding, sudden cover collapse, and leakage around dams. The estimated damage caused by karst hazards every year in Kentucky is between $0.5 million and $1 million.

Karst as Geologic Hazard
A geologic hazard is a naturally occurring geologic condition that may result in property damage or is a threat to the safety of people. Many hazards to man-made structures can be associated with the type of bedrock, the presence of faults, and other earth processes that occur in Kentucky. Earthquakes get the most press coverage and are the most notorious. Annually, landslides, shrink-swell soils, and flooding cause more damage than earthquakes in Kentucky because they happen more often. Karst hazards cause less damage than earthquakes or landslides, perhaps $500,000 to $2,000,000 of economic loss annually, but can still have devastating effect on properties, infrastructures and people.

Four geologic hazards are associated with karst.

- Two common karst-related geologic hazards -- cover-collapse sinkholes and sinkhole flooding -- cause the most damage to buildings.
- A third karst hazard is relatively high concentrations of radon, sometimes found in basements and crawl spaces of houses built on karst.
- Finally, the hydrogeology of karst aquifers makes the groundwater vulnerable to pollution, and this vulnerability may also be considered a type of geologic hazard.

Sinkhole Types

1. ***Cover-Collapse Sinkholes*** occur in the soil or other loose material overlying soluble bedrock. Sinkholes that suddenly appear form in two ways:
    a. In the first way, the bedrock roof of a cave becomes too thin to support the weight of the bedrock and the soil material above it. The cave roof then collapses, forming a bedrock-collapse sinkhole. Bedrock collapse is rare and the least likely way a sinkhole can form, although it is commonly incorrectly assumed to be the way all sinkholes form.
    b. The second way sinkholes can form is much more common and much less dramatic. The sinkhole begins to form when a fracture in the limestone bedrock is enlarged by water dissolving the limestone. As the bedrock is dissolved and carried away underground, the soil gently slumps or erodes into the developing sinkhole. Once the underlying conduits become large enough, insoluble soil and rock particles are carried away too.
    c. Cover-collapse sinkholes can vary in size from 1 or 2 feet deep and wide, to tens of feet deep and wide. The thickness and cohesiveness of the soil cover determine the size of a cover-collapse sinkhole.

2. ***Solution sinkholes*** result from increased groundwater flow into higher porosity zones within the rock, typically through fractures or joints within the rock. An increase of slightly acidic surface water into the subsurface continues the slow dissolution of the rock matrix, resulting in slow subsidence as surface materials fill the voids.

3. ***Raveling sinkholes*** form when a thick overburden of sediment over a deep cavern caves into the void and pipes upward toward the surface. As the overlying material or "plug" erodes into the cavern, the void migrates upward until the cover can no longer be supported and then subsidence begins.

Sinkhole Flooding

Sinkhole flooding is a naturally occurring event that usually follows the same storms that cause riverine flooding, so it is often not recognized as Karst-related. Flood events will differ not only because of the amount of precipitation, but also because the drainage capacity of individual sinkholes can change, sometimes very suddenly, as the Karst landscape evolves. Sinkholes can also flood when their outlets are clogged, preventing water from being carried away as fast as it flows in. Trash thrown into a sinkhole can clog its throat, as can soil eroded from fields and construction sites, or a natural rock fall near the sinkhole's opening. Sometimes the conduit itself is too narrow because it has recently (in the geologic sense) captured a larger drainage basin. The reach of a conduit downstream from constriction could carry a higher flow than it is receiving were it not for this restriction.

Sinkholes flood more easily around development (roofs, parking lots, highways), which increases both the total runoff and the rapidity of runoff from a storm. Another reason that sinkholes flood is back-flooding, the outcome when the discharge capacity of the entire Karst conduit network is exceeded. Some up-gradient sinkholes that drain normally during the short, modest accumulation of storms may become springs that discharge water during prolonged rainfall.

Land Surface Indicators of Sinkhole Collapse

- Circular and linear cracks in soil, asphalt, and concrete paving and floors
- Depressions in soil or pavement that commonly result in ponds of water
- Slumping, sagging, or tilting of trees, roads, rails, fences, pipes, poles, sign boards, and other vertical or horizontal structures
- Downward movement of small-diameter vertical or horizontal structures
- Fractures in foundations and walls, often accompanied by jammed doors and windows
- Small conical holes that appear in the ground over a relatively short period of time
- Sudden muddying of water in a well that has been producing clear water
- Sudden draining of a pond or creek

4.10.2 Profile: Karst/Sinkhole

Karst/Sinkhole Profile Risk Table	
Period of occurrence	Year-round
Campbell County Number of Events	Unknown, 3 mapped sinkholes
Campbell County Probability of Events	N/A
Campbell County Past Damages	$0 recorded
NKU Number of Events	None, 1 mapped sinkhole
NKU Damages Claimed	$0
Warning Time	None to weeks or months, depending on monitoring and maintenance
Potential Impact	Economic losses such as decreased land values and Agro-business losses. May cause minimal to severe property damage and destruction. May cause geological movement, causing infrastructure damages.
Potential of Injury or Death	Injury and slight chance of death
Potential Duration of Facility Shutdown	Days to months
Extent	Typical sinkholes in the area range from 1 foot to 10 foot in width, and cause destruction to small sections of roadways or part of structures.

Historical Impacts

Kentucky contains one of the world's largest Karst-ridden topographies. Springs and wells in Karst areas supply water to tens of thousands of homes. Much of Kentucky's prime farmland is underlain by Karst, as is a substantial amount of the Daniel Boone National Forest with its important recreational and timber resources.

Caves are also important Karst features, providing recreation and unique ecosystems. Mammoth Cave is the longest surveyed cave in the world, with more than 350 miles of passages. Two other caves in the state stretch more than 30 miles, and nine Kentucky caves are among the 50 longest caves in the U.S.

The most noticeable hazards in Kentucky are sinkhole flooding and cover collapse. Soil collapses are common in karst terrain, where water drains to caves through fissures in the bedrock. Over time, domes of soil form over these fissures and new development increases the drainage into these fissures, forming a sinkhole. Unfortunately, collapses are seldom reported to any central agency. Damage to infrastructure from sinkhole flooding and cover collapse is so common in Kentucky that it is typically dealt with by local authorities as a routine matter.

The NKU main campus and most of Campbell County are in an area of moderate karst risk. The Biology Field Station is located in an area of low karst risk. There are three KGS confirmed sinkholes in Campbell County and one on the NKU campus. During the Risk Assessment Workshop, stakeholders identified two suspected sinkholes between Faren Drive and Sunset Drive, behind a few of the NKU-owned rental houses. NKU has not recorded any damage to university property caused by sinkholes.

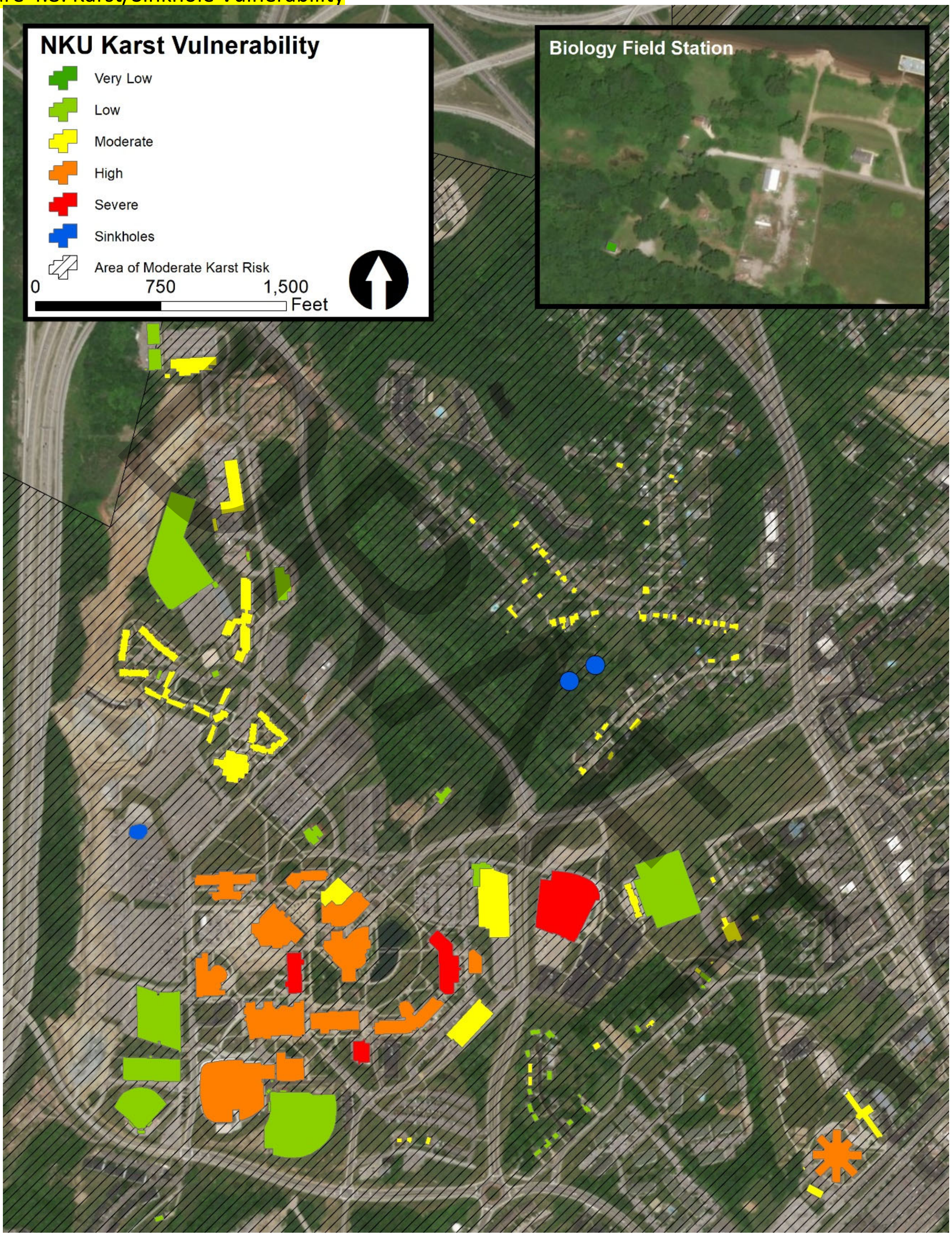
4.10.3 Assessing Vulnerability: Karst/Sinkhole

Karst Vulnerability Score = Exposure Score + Hazard Score

The Karst/Sinkhole Hazard Score was determined by the building's or structure's location, either in an area of moderate karst risk or not. All main campus buildings and structures are in the area of moderate karst risk and received a Karst Hazard Score of 1, while the Biology Field Station is in an area of low risk and received a score of 0.

The Hazard Score and the Exposure Score were added together and an overall Karst/Sinkhole Vulnerability Score (0-1) was calculated for each building. The Karst/Sinkhole Vulnerability Scores are displayed in Figure 4.8.

Figure 4.8: Karst/Sinkhole Vulnerability



Sources: NKU, KGS, ESRI

4.11 Landslide

4.11.1 Identify: Landslide

Landslides occur when masses of rock, earth, or debris move down a slope. Landslides may be very small or very large and can move at slow to very high speeds. Many landslides have been occurring over the same terrain since prehistoric times. They are activated by storms and fires and by human modification of the land. New landslides occur as a result of rainstorms, earthquakes, volcanic eruptions, and various human activities.

Mudflows or debris flows are rivers of rock, earth, and other debris saturated with water. They develop when water rapidly accumulates in the ground, such as during heavy rainfall or rapid snowmelt, changing the earth into a flowing river of mud or "slurry." A slurry can flow rapidly down slopes or through channels and can strike with little or no warning at avalanche speeds. A slurry can travel several miles from its source, growing as it picks up trees, cars, and other materials along the way.

Most of the landslide damage does not occur in rugged mountain country. Most losses from landslides and soil creep occur in cities developed on gently sloping hillsides. Although a landslide may occur almost anywhere, from man-made slopes to natural, pristine ground, most slides often occur in areas that have experienced sliding in the past. All landslides are triggered by similar causes. These can be weaknesses in the rock and soil, earthquake activity, the occurrence of heavy rainfall or snowmelt, or construction activity changing some critical aspect of the geological environment. Landslides that occur following periods of heavy rain or rapid snow melt worsen the accompanying effects of flooding.

Landslides pose a hazard to nearly every state in the country by causing $2 billion in damages and 25 to 50 deaths a year. There is a concentration of losses in the Appalachian, Rocky Mountain and Pacific Coast regions. It has been estimated that about 40 percent of the U.S. population has been exposed to the direct and indirect effects of landslides.

Public and private economic losses from landslides include not only the direct costs of replacing and repairing damaged facilities, but also the indirect cost associated with lost productivity, disruption of utility and transportation systems, reduced property values, and costs for any litigation. Some indirect costs are difficult to evaluate; thus, estimates are usually conservative or simply ignored. If indirect costs were realistically determined, they likely would exceed direct costs.

Much of the economic loss is borne by federal, state, and local agencies responsible for disaster assistance, flood insurance, and highway maintenance and repair. Private costs involve mainly damage to land and infrastructures. A severe landslide can result in financial ruin for the property owners because landslide insurance (except for debris flow coverage) or other means of spreading the costs of damage are unavailable.

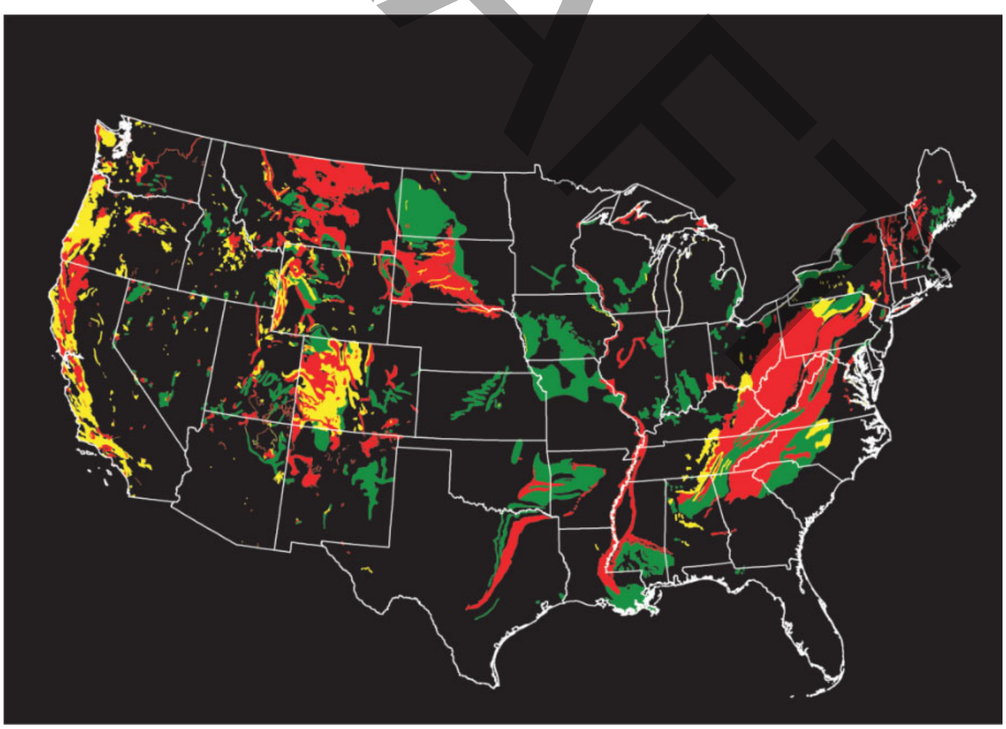
Types

- *Slides* of soil or rock involve downward displacement along one of more failure surfaces. The material from the slide may be broken into several pieces or remain a single, intact mass. Sliding can be rotational, where movement involves turning about a specific point. Sliding can be translational, where movement is down slope on a path roughly parallel to the failure surface.

The most common example of a rotational slide is a slump, which has a strong, backward rotational component and a curved, upwardly-concave failure surface.

- *Flows* are characterized by shear strains distributed throughout the mass of material. They are distinguished from slides by high water content and distribution of velocities resembling that of viscous fluids. Debris flows are common occurrences in much of North America. These flows are a form of rapid movement in which loose soils, rocks, and organic matter, combined with air and water, form slurry that flows downslope. The term "debris avalanche" describes a variety of very rapid to extremely rapid debris flows associated with volcanic hazards. Mudflows are flows of fine-grained materials, such as sand, silt, or clay, with high water content. A subcategory of debris flows, mudflows contains less than 50 percent gravel.
- *Lateral spreads* are characterized by large elements of distributed, lateral displacement of materials. They occur in rock, but the process is not well-documented, and the movement rates are very slow. Lateral spreads can occur in fine-grained, sensitive soils such as quick clays, particularly if remolded or disturbed by construction and grading. Loose, granular soils commonly produce lateral spread through liquefaction. Liquefaction can occur spontaneously, presumably because of changes in pore-water pressures, or in response to vibrations such as those produced by strong earthquakes.
- *Falls and Topples*. Falls occur when masses of rock or other material detach from a steep slope or cliff and descend by free fall, rolling, or bouncing. These movements are rapid to extremely rapid and are commonly triggered by earthquakes. Topples consist of forward rotation of rocks or other materials about a pivot point on a hill slope. Toppling may culminate in abrupt falling, sliding, or bouncing, but the movement is tilting without resulting in collapse. Data on rates of movement and control measures for topples is sparse.

USGS United States Landslide Susceptibility Map



Source: U.S. Geological Survey. 2005. http://pubs.usgs.gov/fs/2005/3156/2005-3156.pdf

Facts

- Steep slopes are more susceptible to landslides and should be avoided when choosing a building site.
- Slope stability decreases as water moves into the soil. Springs, seeps, roof runoff, gutter down spouts, septic systems, and site grading that cause ponding or runoff are sources of water that often contribute to landslides.
- Changing the natural slope by creating a level area where none previously existed adds weight and increases the chance of a landslide.
- Poor site selection for roads and driveways.
- Improper placement of fill material.
- Removal of trees and other vegetation. Plants, especially trees, help remove water and stabilize the soil with their extensive root systems.

4.11.2 Profile: Landslide

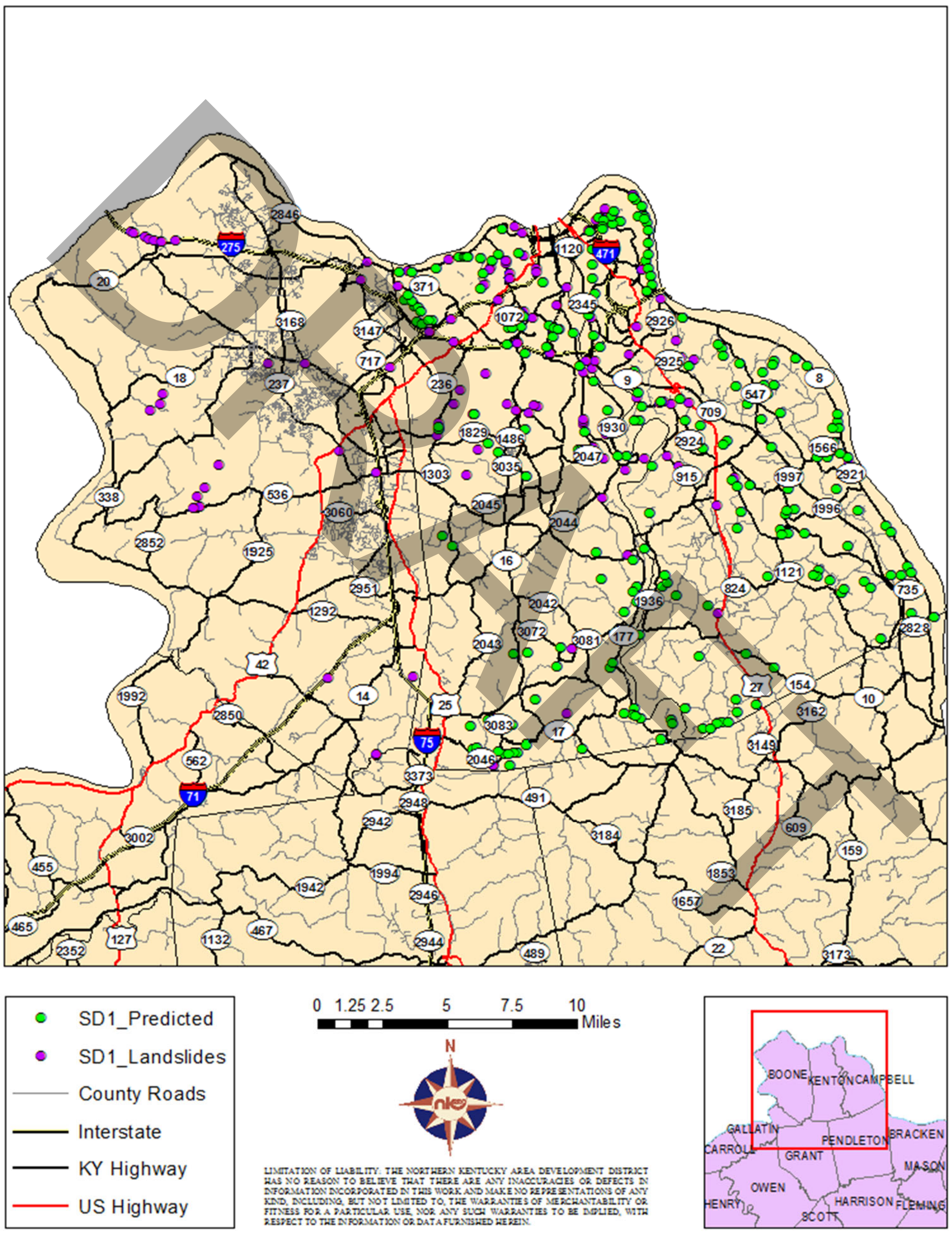
Landslide Profile Risk Table	
Period of occurrence	Anytime, but chance increases after heavy rain, snow/ice melt, or construction activities
Campbell County Number of Events	173 (KGS confirmed) 45 years (1973-2018)
Campbell County Probability of Events	3.88
Campbell County Past Damages	$950,128 (not including most county roads) Annualized $24,632 (NKADD)
NKU Number of Events	0
NKU Damages Claimed	$0
Warning Time	None, but chance increases after heavy rain, snow/ice melt, or construction activities.
Potential Impact	Economic losses such as decreased land values, infrastructure damage, and agro-business losses. May cause minimal to severe property damage and destruction.
Potential of Injury or Death	Injury and chance of death
Potential Duration of Facility Shutdown	Days to months
Extent	No current measurement to compare severity of events. Some small slides cause a lot of property damage, while some large slides cause minimal damage. From the limited information we have available, the largest slide in Campbell was on an unspecified date in Alexandria on Sheridan Drive, costing about $275,000 (SD1).

Historical Impacts

Kentucky's landslides have occurred in all regions of the state, mostly in the Ohio River Valley, the Knobs, the Outer Bluegrass, and the Eastern Kentucky Coal Field. Since the early 1970's the Kentucky Transportation Cabinet and the Kentucky Transportation Center have received reports of approximately 3,000 landslides. Landslide problems in Kentucky are usually related to certain rock formations on yield soils which are unstable on moderate to steep slopes. Often, slopes are cut into or over-steeped to create additional level land for development. Costs for repair of landslides exceed $2 million annually. Thousands of slides are unrelated to transportation, however, and many are unreported. These also pose significant hazards to people and infrastructure. Kentucky has experienced at least 10 Presidentially declared disasters that included landslides. Only the most recent, DR-4361 in 2018 included Campbell County.

Northern Kentucky experiences a large number of landslides, with 173 confirmed by KGS in Campbell County. Additionally, Sanitation District 1 (SD1), northern Kentucky's sanitary and storm sewer provider, monitors past and predicted landslide events (Figure 4.9). There have been no confirmed landslides on the NKU campus.

Figure 4.9: SDI Monitored Landslides



Source: Northern Kentucky 2017 Regional Natural Hazard Mitigation Plan

The most landslide prone road in Campbell County is KY 8. There are multiple sections in Campbell County that frequently experience slides. Some of these slides are due to repeated flooding, but often it is due to the geography and soil types on which the road is located. The Campbell County Road Department and Planning Office estimate the County will need to spend about $100,000 each year for the next 10 years on slide related repairs on county roads. (Northern Kentucky 2017 Regional Natural Hazard Mitigation Plan)

4.11.3 Assessing Vulnerability: Landslide

Landslide Vulnerability Score – Exposure Score + Hazard Score

The Landslide Hazard Score was derived from the Landslide Susceptibility hazard map created for the 2018 Commonwealth of Kentucky Hazard Mitigation Plan. This map was created by KGS and incorporates geology and slope. The geology and slope maps (raster images) were reclassified based on a matrix of weighted scores that were assigned to particular geologic formations and ranges of slope values. The weighted score for slope doubled with each increasing slope range. The weighted score for the geology ranged from 10 to 40 depending on the rock type. Using the ArcGIS Weighted Sum tool, the newly reclassified values of both raster map layers were multiplied by an assigned weight and then values for both layers were added together (Eq. 2-1). In order to have slope be a greater influence on the susceptibility model, a 70 percent weight was assigned for slope and a 30 percent weight was assigned for geology.

Landslide Hazard Score (susceptibility value) = geology reclass value x 0.30) + (slope reclass value x 0.70)

The Landslide Hazard Score and Exposure Score were added together and an overall Landslide Vulnerability Score (0-1) was calculated for each building. The Landslide Vulnerability Scores are displayed in Figure 4.10.

Figure 4.10: Landslide Vulnerability

Sources: NKU, KGS, ESRI

4.12 Severe Storm

4.12.1 Identify: Severe Storm

A thunderstorm is formed from a combination of moisture, rapidly rising warm air, and a force capable of lifting air such as a warm and cold front, a sea breeze or a mountain. All thunderstorms contain lightning and may occur singly, in clusters or in lines. Thus, it is possible for several thunderstorms to affect one location in the course of a few hours. Some of the most severe weather occurs when a single thunderstorm affects one location for an extended period time. The NWS considers a thunderstorm as severe if it develops ¾ inch hail or 50-knot (58 mph) winds.

Lightning is an electrical discharge that results from the buildup of positive and negative charges within a thunderstorm. When the buildup becomes strong enough, lightning appears as a "bolt". This flash of light usually occurs within the clouds or between the clouds and the ground. A bolt of lightning reaches a temperature approaching 50,000 degrees Fahrenheit in a split second. The rapid heating and cooling of air near the lightning causes thunder.

Additional types of severe storms include *straight line winds*. There are several terms that mean the same as straight-line winds and they are convective wind gusts, outflow and downbursts. Straight-line wind is wind that comes out of a thunderstorm. If these winds meet or exceed 58 miles per hours, then the storm is classified as *severe* by the National Weather Service. These winds are produced by the downward momentum in the downdraft region of a thunderstorm.

Radar observers use the intensity of the radar echo to distinguish between rain showers and thunderstorms. Lightning detection networks routinely track cloud-to-ground flashes, and therefore thunderstorms.

Thunderstorms occur when clouds develop sufficient upward motion and are cold enough to provide the ingredients (ice and super cooled water) to generate and separate electrical charges within the cloud. The cumulonimbus cloud is the perfect lightning and thunder factory, earning its nickname, "thunderhead".
All thunderstorms are dangerous and capable of threatening life and property in localized areas. While thunderstorms and lightning can be found throughout the U. S., they are most likely to occur in the central and southern states. Thunderstorms can also produce large, damaging hail, which causes nearly $1 billion in damage to property and crops annually. Thunderstorms are also capable of producing tornadoes, wind, and heavy rain that can lead to flash flooding. hail, floods, and tornado hazards are addressed as individual hazards in this section of the plan.

Types of Thunderstorms

- *Single Cell* (pulse storms). Typically, last 20-30 minutes. Pulse storms can produce severe weather elements such as downbursts, hail, some heavy rainfall, and occasionally weak tornadoes. This storm is light to moderately dangerous to the public and moderately to highly dangerous to aviation.
- *Multicell Cluster*. These storms consist of a cluster of storms in varying stages of development. Multicell storms can produce moderate size hail, flash floods, and weak tornadoes. This storm is moderately dangerous to the public and moderately to highly dangerous to aviation.
- *Multicell Line*. Multicell line storms consist of a line of storms with a continuous, well-developed gust front at the leading edge of the line. Also known as squall lines, these storms can produce

small to moderate size hail, occasional flash floods, and weak tornadoes. This storm is moderately dangerous to the public and moderately to highly dangerous to aviation.

- *Supercell*. Even though it is the rarest of storm types, the supercell is the most dangerous because of the extreme weather generated. Defined as a thunderstorm with a rotating updraft, these storms can produce strong downbursts, large hail, occasional flash floods, and weak to violent tornadoes. This storm is extremely dangerous to the public and aviation.
- *Straight-line winds*, which in extreme cases have the potential to exceed 100 miles per hour, are responsible for most thunderstorm wind damage. One type of straight-line wind, the downburst, can cause damage equivalent to a strong tornado and can be extremely dangerous to aviation.

Thunderstorm Facts

The NWS estimates more than 100,000 thunderstorms in the U. S. each year. In the last 25 years, severe storms have been involved in over 300 federal disasters

4.12.2 Profile: Severe Storm

Severe Storm Profile Risk Table	
Period of occurrence	Spring, Summer, Fall
Campbell County Number of Events	99 events (Recorded by NCEI) 62 years (1955-2017)
Campbell County Probability of Events	1.6
Campbell County Past Damages	Recorded Losses: $10,714,000 Annualized Losses: $172,806
NKU Number of Events	3 (2014-2017)
NKU Damages Claimed	$15,884
Warning Time	Minutes to hours
Potential Impact	Impacts to human life, health and public safety are possible. Utility damage and failure, infrastructure damage, structural damage, fire, damaged or destroyed critical facilities, and hazardous material releases are additional impacts.
Potential of Injury or Death	Injury and chance of deaths
Potential Duration of Facility Shutdown	Days to Weeks
Extent	4/3/2015 – Lightning Strike to BB&T Arena, $10,569 in damages

Historical Impacts

Since the NCEI began tracking severe storm events in 1950, there have been 99 recorded events in Campbell County. Because severe storms are not typically contained in a specific location, it is assumed the Campbell County events could have similar impact on the NKU campus.

In 2014 and 2015, NKU experienced 3 severe storm events with recorded damages:

- 2014 – Lightning strike to Founders Hall (date not recorded) causing $560 in damages
- 3/24/2015 – Roof damage to 13 Clearview Drive causing $4,754.95 in damages
- 4/3/2015 – Lightning strike to BB&T Arena causing $10,569 in damages

Campbell County's more significant severe storm events include:

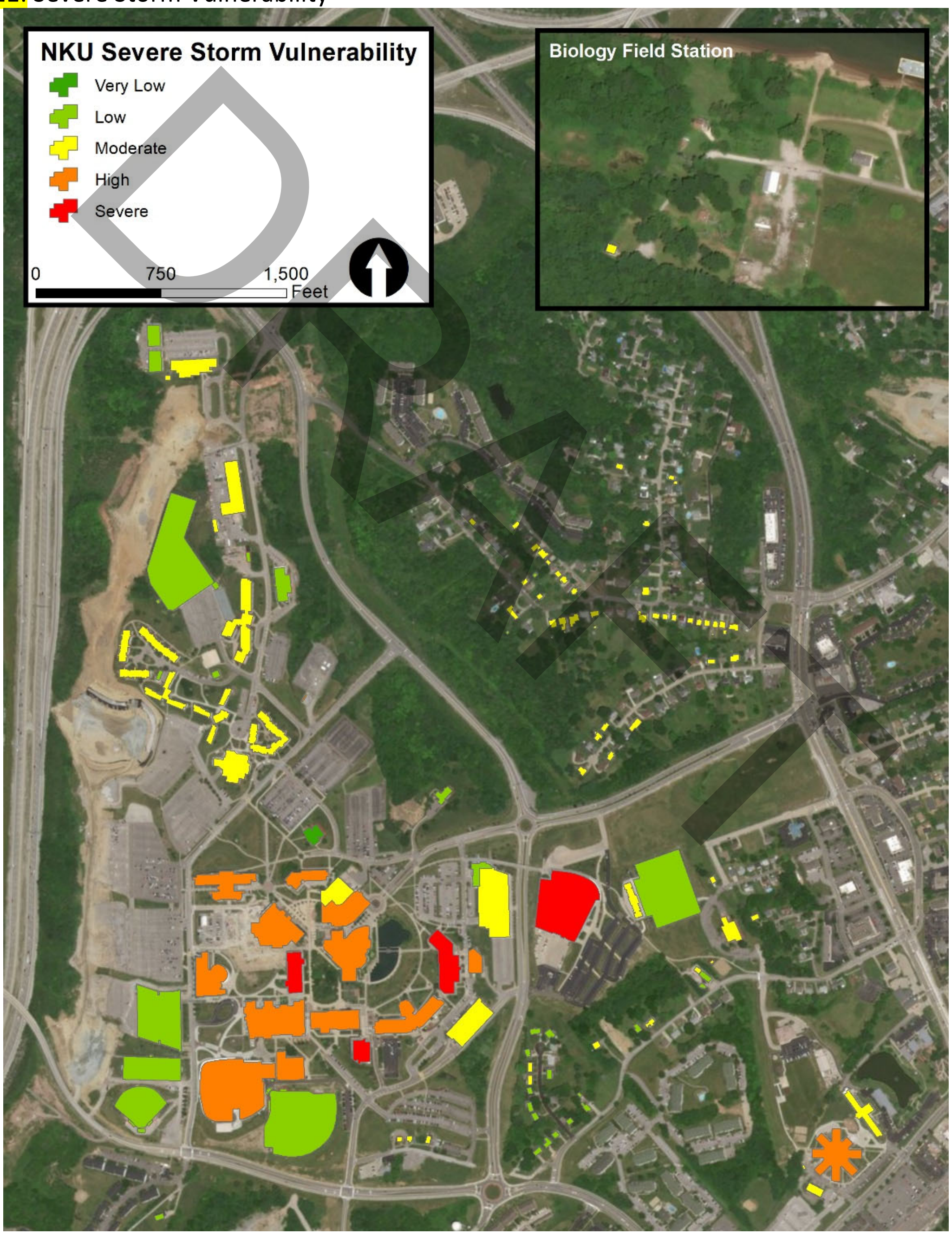
- High Wind (Straight Line Wind), 9/14/2008: The remnants of Hurricane Ike raced northeast through the mid-west and merged with a frontal boundary across the lower Ohio Valley Sunday morning. Abundant sunshine promoted deep mixing of the atmosphere, and warm, dry air aloft translated down to the surface. Gusty winds in excess of 70 mph persisted for a period of several hours, causing significant damage. Over 700,000 power outages occurred for Duke energy customers in the Cincinnati area, some taking over a week to be restored. Strong winds of 40 to 50 miles per hour were sustained for several hours. Gusts over 60 mph were common. Widespread damage occurred across the region, from trees being blown down on power lines to significant structural damage.
- High Wind (Straight Line Wind), 2/11/2009: A cold front crossed the Ohio Valley on the evening of the 11th. A very tight pressure gradient behind this front in the cold air created damaging winds during the late evening of the 11th. Several trees were downed in Fort Thomas.
- High Wind (Straight Line Wind), 12/9/2009: A strong center of low pressure tracked out of the plain's states to the Great Lakes region. Ahead of this low in the Ohio Valley, southwest winds of 30 to 40 mph with gusts to 50 and 60 mph were common throughout the day. These strong winds peaked in the early afternoon with the passage of a cold front and diminished later in the evening. A few trees and large limbs were blown down across the county.
- Thunderstorm, 1/30/2013: An organized line of storms developed ahead of a cold front during the overnight hours. Some of these storms along the line produced severe weather. The main threat from these storms was damaging winds. Trees were reported down along Stonehouse Road due to damaging thunderstorm winds.
- Thunderstorm, 6/26/2013: Thunderstorms developed in an unstable air mass ahead of an approaching disturbance. Some of these storms became severe. The main threat from these storms was damaging winds. Trees and branches were downed near Moock road and Canterbury Apartments due to thunderstorm winds.
- Thunderstorm, 8/31/2013: Disturbances moving along a stalled frontal boundary interacted with an unstable air mass to produce numerous showers and thunderstorms across the area. Some of these storms organized and became severe. The main threat from these storms was damaging winds. A tree fell on a house near Alexandria due to thunderstorm winds.
- Thunderstorm, 11/17/2013: A strong low-pressure system combined with an unseasonably warm airmass to produce organized storms across the region. These storms were tornadic across Illinois and western Indiana and began to transition to non-tornadic storms as they entered northern Kentucky. The main threat from these storms when they moved across northern Kentucky was damaging thunderstorm winds. Roof and fascia damage occurred to a shopping plaza due to thunderstorm winds.
- Thunderstorm, 12/21/2013: Low pressure drew an unseasonably warm and moist air mass across the region. Convection organized ahead of the low and brought heavy rainfall and damaging winds to the area from the evening of the 21st into the morning of the 22nd. Numerous large trees were down in Alexandria and surrounding areas due to thunderstorm winds.
- Thunderstorm, 5/10/2014: A disturbance moving east across the region produced thunderstorms during the afternoon. Isolated severe weather was possible with damaging winds being the primary threat. A few large limbs were blown down due to thunderstorm winds.

4.12.3 Assessing Vulnerability: Severe Storm

Severe Storm Vulnerability Score = Exposure Score + Hazard Score

Variations in severe storm occurrences are difficult to identify at the county level, and even more difficult at the campus level. Because NKU only has three recorded occurrences and the campus is relatively small, the Severe Storm Hazard Score is assumed to be the same for all university buildings. Therefore, the Exposure Score represents the Severe Storm Vulnerability Score.

Figure 4.11: Severe Storm Vulnerability



Sources: NKU, NCEI, ESRI

4.13 Severe Winter Storm

4.13.1 Identify: Severe Winter Storm

A winter storm can range from moderate snow over a few hours to blizzard conditions with blinding wind-driven snow, sleet and/or ice and extreme cold that lasts several days. A severe winter storm is defined as an event that drops four or more inches of snow during a 12-hour period or six or more inches during a 24-hour span. Severe winter storms are fueled by strong temperature gradients and an active upper-level cold jet stream. Some winter storms may be large enough to affect several states while others may affect only a single community. Most winter storms are accompanied by low temperatures and blowing snow, which can severely reduce visibility.

Snow and ice are threats to most of the U. S. during the northern hemisphere's winter, which begins December and ends in Spring. During the early and late months of the winter season, snow becomes warmer, giving it a greater tendency to melt on contact or stick to the surface. The beginning and end of the winter season also brings a greater chance of freezing rain and sleet.

Types

Blizzards are by far the most dangerous of all winter storms. They are characterized by temperatures below twenty degrees Fahrenheit and winds of at least 35 miles per hour. In addition to the temperatures and winds, a blizzard must have a sufficient amount of falling or blowing snow. The snow must reduce visibility to one-quarter mile or less for at least three hours. With high winds and heavy snow, these storms can punish residents throughout much of the U.S. during the winter months each year. In mid-March of 1993, a major blizzard struck the Eastern U.S., including parts of Kentucky.

Ice storms occur when freezing rain falls from clouds and freezes immediately on impact. Ice storms occur when cold air at the surface is overridden by warm, moist air at higher altitudes. As the warm air advances and is lifted over the cold air, precipitation begins falling as rain at high altitudes then becomes super cooled as it passes through the cold air mass below, and, in turn, freezes upon contact with chilled surfaces at temperatures of 32º F or below. In extreme cases, ice may accumulate several inches thick, though just a thin coating is often enough to do severe damage.

Winter Storm Facts

- Winter storms have been known to occur in the time period between the end of October and the end of March.
- Every state in the continental U.S. and Alaska has been impacted by severe winter storms.
- The super-storm of March 1993 caused over $2 billion in property damage in twenty states and Washington D.C. At least 79 deaths and 600 injuries were attributed to the storm.

Possible Effects

Freezing rain can result in extensive damage to utility lines and buildings while making any type of travel extremely dangerous. The results are sometimes devastating: entire states can be almost entirely without electricity and communication for several weeks. Winter storms can paralyze a community by shutting down normal day-to-day operations. Heavy snow can also lead to the collapse of weak roofs or unstable structures. Storm effects can cause hazardous conditions and hidden problems, including the following:

- *Power outages* result when snow and ice accumulate on trees causing branches and trunks to break and fall onto power lines. Blackouts vary in size from one street to an entire city. Loss of electric power means loss of heat for some residents, which poses a significant threat to human life, particularly the elderly.
- *Flooding* may occur after precipitation has accumulated and then temperatures rise once again, which melts snow and ice. In turn, as more snow and ice accumulate the threat of flooding increases.
- *Snow and ice accumulation on roadways* can cause severe transportation problems in the form of extremely hazardous roadway conditions.
- *Extreme cold* temperatures may lead to frozen water mains and pipes, damaged car engines, and prolonged exposure to cold resulting in frostbite.

Everyone is potentially at-risk during winter storms. In terms of death due to severe winter storms, 70% of the deaths are related to automobile accidents. 25% of those deaths occur when people are caught out in the storm and die from exposure. Of all the deaths related to exposure to cold, 20% occur at home.

4.13.2 Profile: Severe Winter Storm

Severe Winter Storm Profile Risk Table	
Period of occurrence	October through April
Campbell County Number of Events	52 events (Recorded by NCEI) 21 years (1996-2017)
Campbell County Probability of Events	2.47
Campbell County Past Damages	Recorded Losses: $300,000 Annualized Losses: $14,286
NKU Number of Events	0 recorded
NKU Damages Claimed	$0 recorded
Warning Time	Days for snow, Minutes to hours for ice
Potential Impact	Utility damage and outages, infrastructure damage (transportation and communication systems), structural damage, and damaged or destroyed critical facilities Can cause severe transportation problems and make travel extremely dangerous. Power outages, which results in loss of electrical power and potentially loss of heat, and human life. Extreme cold temperatures may lead to frozen water mains and pipes, damaged car engines, and prolonged exposure to cold resulting in frostbite.
Potential of Injury or Death	Injury and slight chance of deaths
Potential Duration of Facility Shutdown	Days
Extent	Blizzard of 1996. Over 14 inches of snow and $300,000 in recorded damages in Campbell County

Historical Impacts
Since the NCEI began tracking winter storm events in 1996, there have been 52 recorded events in Campbell County. Because severe winter storms are not typically contained in a specific location, it is assumed the Campbell County events could have similar impact on the NKU campus.

Campbell County's more significant severe winter storm events include:

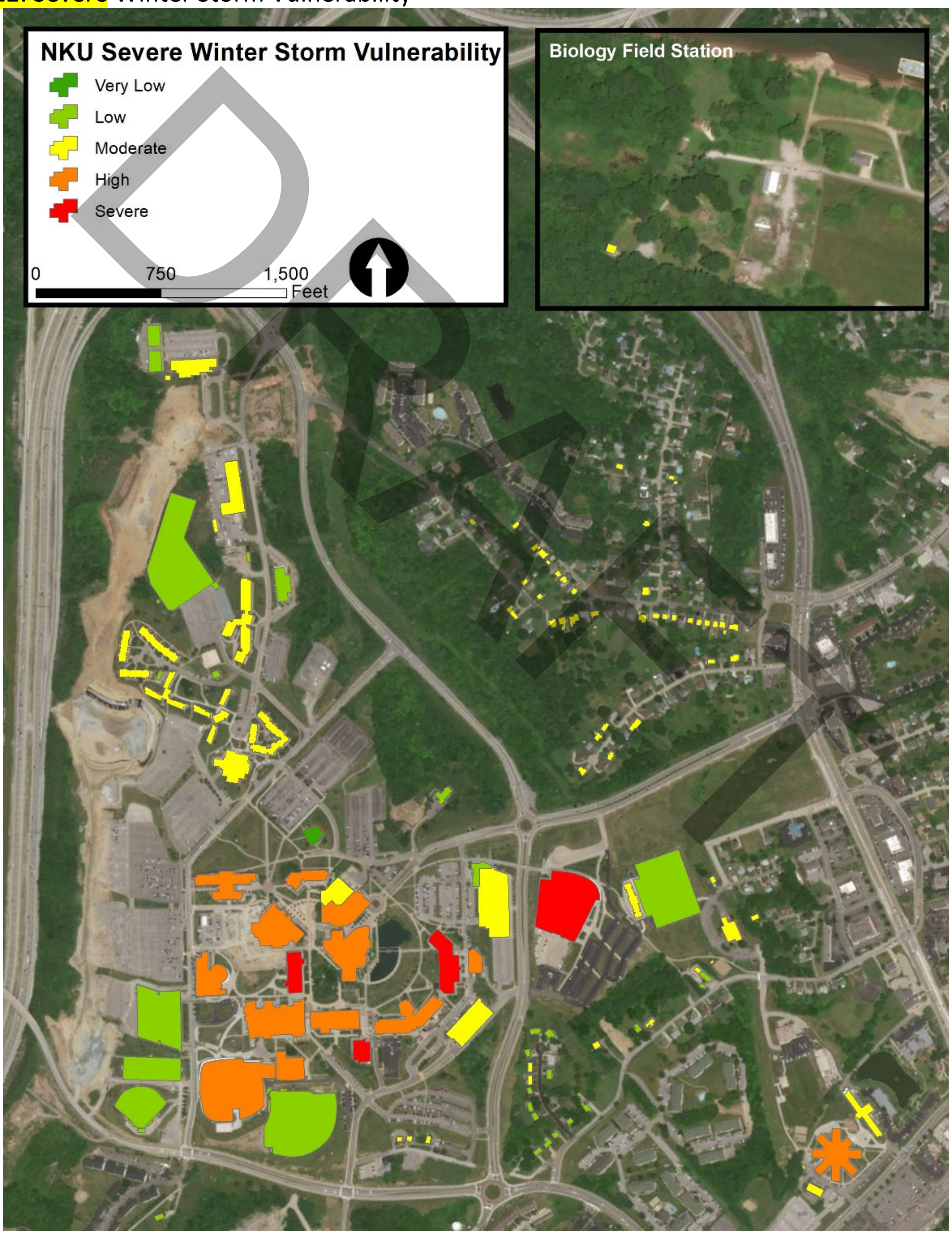
- Ice Storm, 1/27/09: A frontal boundary was stalled over the Tennessee Valley for the early part of the week. Upper level disturbances crossed through the Ohio Valley during this time and accumulating snowfall began on Tuesday. Warmer air aloft on Tuesday afternoon brought a significant amount of freezing rain to Kentucky. Almost eight inches of snow accumulated over northern portions of the county. Significant sleet and freezing rain caused icy accumulation of almost an inch, which cut down on the total snow amounts.
- Heavy Snow, 1/20/11: A low pressure system moved across the Tennessee Valley during the day of Thursday, January 20th. Widespread snow developed across the region in the morning and continued through the afternoon, tapering off in the evening. Snow became heavy at times during the afternoon. The county garage in Alexandria measured 4.5 inches of snowfall.
- Winter Storm, 2/4/14: A fast moving winter storm moved across the Ohio Valley on Tuesday evening, February 4th. Locations across northern Kentucky and southern Ohio started with heavy snow and transitioned to sleet and freezing rain. Significant ice accumulations caused tree damage and power outages to 5-10,000 people. Further north, snow mixed briefly with sleet, before changing to freezing rain as precipitation tapered off. The resulting 5 to 10 inches of snow and sleet accumulation in west-central and central Ohio. This storm brought widespread travel impacts with many schools and businesses being closed on Wednesday, February 5th. Snow, sleet, and freezing rain caused a large disruption to the region. Two to three inches of snow were found across the county before the mixed precipitation cut snowfall totals significantly.
- Winter Storm, 2/14/14: A strong upper-level disturbance moved through the Ohio Valley Friday evening, February 14th, ending on Saturday morning, February 15th. Surface low pressure crossed east across the state of Kentucky at the same time, allowing for an extended period of snow to develop. The Fort Thomas Fire Department measured 4 inches of snow.
- Winter Storm, 3/2/14: A low pressure system moving through the Tennessee Valley combined with a cold front dropping down across the Ohio Valley to produce widespread freezing rain, sleet and snow across the area. The precipitation remained mainly snow along and north of Interstate 70. However, to the south, the precipitation began as rain and freezing rain before changing to sleet and then snow through the afternoon and evening hours of March 2nd. Snow then continued along and south of the Ohio River through much of the night and on into the morning hours of March 3rd. Snow and ice caused numerous wrecks were across the region, and Interstate 275 was closed for several hours due to the adverse conditions.
- Winter Storm, 11/16/14: A surge of cold air worked into the Ohio Valley with an upper level disturbance pivoting through the region on Sunday night, November 16th. This cold surge changed any rain that was in the area to snow overnight for areas west of the I-75 corridor. East of this line, the changeover to snow did not occur until Monday and there were significantly lower snowfall amounts recorded here. Based on nearby surrounding observations, it is estimated that 4 to 5 inches of snow had fallen over much of Campbell County.

4.13.3 Assessing Vulnerability: Severe Winter Storm

Severe Winter Storm Vulnerability Score = Exposure Score + Hazard Score

Variations in severe storm occurrences are difficult to identify at the county level, and even more difficult at the campus level. Because NKU does not have any recorded occurrences and the campus is relatively small, the Severe Winter Storm Hazard Score is assumed to be the same for all university buildings. Therefore, the Exposure Score represents the Severe Winter Storm Vulnerability Score.

Figure 4.12: Severe Winter Storm Vulnerability



Sources: NKU, NCEI, ESRI

4.14 Tornado

4.14.1 Identify: Tornado

A tornado is a violent windstorm characterized by a twisting, funnel-shaped cloud. It is spawned by a thunderstorm (or sometimes as a result of a hurricane) and produced when cool air overrides a layer of warm air, forcing the warm air to rise rapidly. The damage from a tornado is a result of the high wind velocity (up to 250 mph) and wind-blown debris with paths that can be in excess of one mile wide and fifty miles long. They have been known to blow off roofs of houses, move cars and tractor trailers, and demolish homes. Peak months of tornado activity for Kentucky and south-central Indiana are usually April, May and June. However, tornadoes have occurred in every month and at all times of the year. They tend to occur in the afternoons and evenings; over 80 percent of all tornadoes strike between noon and midnight.

Types

The magnitude of a tornado is categorized by its damage pattern (i.e. path) and its wind velocity, according to the Fujita-Pearson Tornado Measurement Scale. This scale is the only widely used rating method. Its aim is to validate classification by relating the degree of damage to the intensity of the wind.

The Fujita-Pearson Tornado Measurement Scale

Fujita Scale	Estimated Wind Speed (mph)	Typical Damage
F0	< 73	Light Damage - Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; signboards damaged.
F1	73 - 112	Moderate Damage - Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.
F2	113 - 157	Considerable Damage - Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light object missiles generated; cars lifted off ground.
F3	158 - 206	Severe Damage - Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.
F4	207 - 260	Devastating Damage - Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown, and large missiles generated.
F5	261 - 318	Incredible Damage - Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yards); trees debarked; incredible phenomena will occur.

Facts

- World-wide, about 1,000 tornadoes are generated by severe thunderstorms each year.
- Earthquake-induced fires and forest fires may also produce tornadoes.
- A tornado can move as fast as 125 mph with internal winds speeds exceeding 300 mph.
- Powerful tornadoes have lifted and moved objects weighing more than 300 tons a distance of thirty feet and have tossed homes greater than 300 feet away from their foundations.
- During an outbreak from May 4-10 of 2003, 334 tornadoes were recorded.

- In the entire month of May 2003, 559 tornadoes were reported.
- On April 3, 1974, 148 tornadoes in 13 states killed 315 people.
- The path of a tornado can be many miles long, but tornadoes rarely last longer than 30 minutes.

4.14.2 Profile: Tornado

Tornado Profile Risk Table	
Period of occurrence	Spring, Summer, Fall, Winter
Campbell County Number of Events	3 events (NCEI) 67 years (1950-2017)
Campbell County Probability of Events	.04
Campbell County Past Damages	Recorded Losses: $1,275,000 Annualized Loss $19,030
NKU Number of Events	0 recorded
NKU Damages Claimed	$0 recorded
Warning Time	Minutes to hours
Potential Impact	Utility damage and outages, infrastructure damage (transportation and communication systems), structural damage, fire, damaged or destroyed critical facilities, and hazardous material releases. Impacts human life, health, and public safety.
Potential of Injury or Death	Injury and slight chance of deaths
Potential Duration of Facility Shutdown	Days to months
Extent	3/2/2012 - EF3 tornado, $1,000,000 in recorded damages in Campbell County

Historical Impacts

Since the NCEI began tracking tornado events in 1950, there have been 3 recorded events in Campbell County. Because the exact locations of tornadoes are difficult to predict, it is assumed the Campbell County events could have similar impact on the NKU campus. Campbell County's tornado events include:

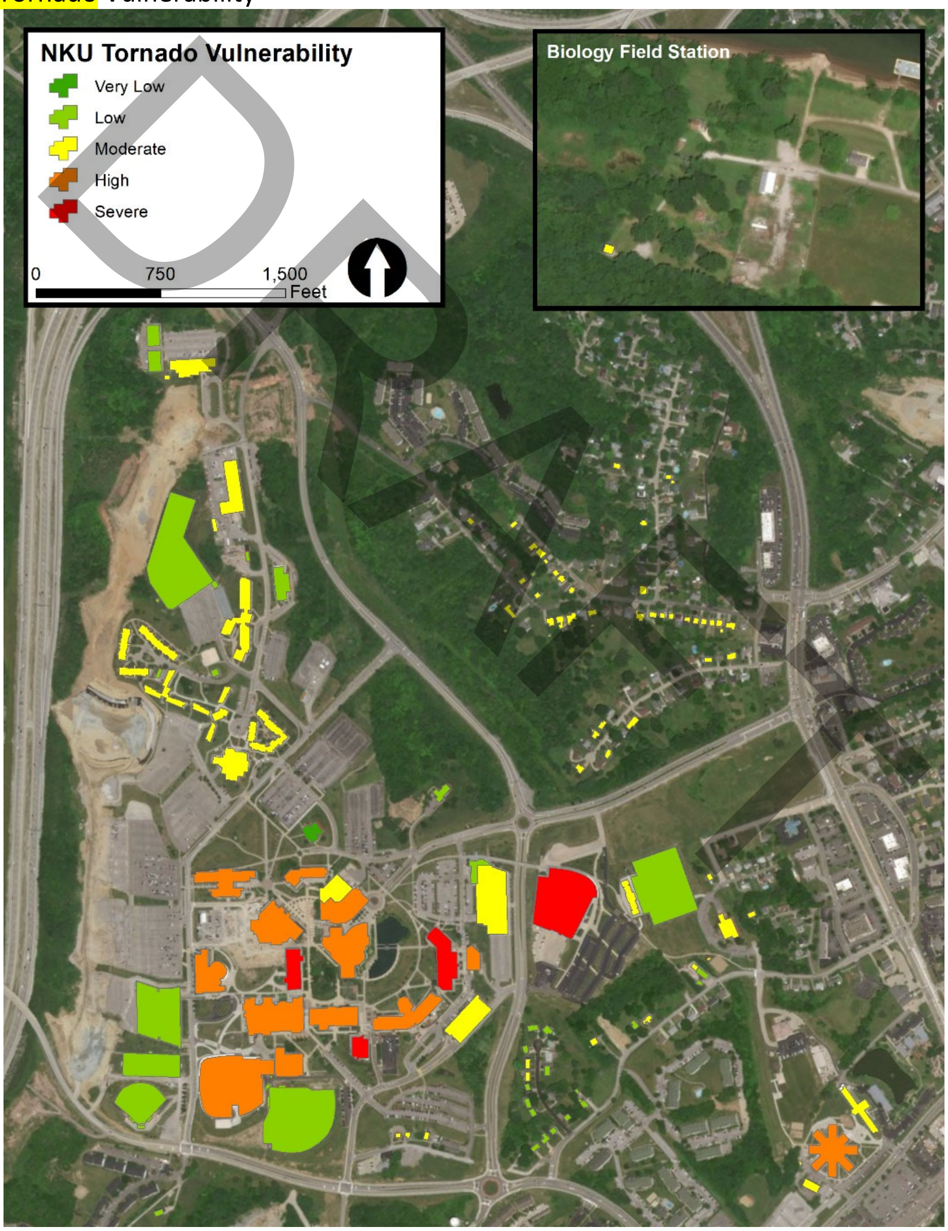
- 7/11/1958: An F2 tornado touched down in northern Campbell County. Eight injuries were recorded as well as $250,000 in damages.
- 11/25/1973: An F1 tornado touched down in southern Campbell County and "Skipped for some 4 miles through farm country damaging several homes and barns." Two injuries were reported as well as $25,000 in damages.
- 3/2/2012: An F3 tornado touched down in southern Campbell County. Multiple tornadoes were recorded in the region associated with the same storm system. The tornado initially touched down near Peach Grove Road and crossed Fisher Road northwest of Peach Grove. Based on the damage surveyed, the maximum wind speed of the tornado was estimated to be 160 miles per hour in Campbell County and 140 miles per hour in Pendleton County. The tornado traveled a total of 2.68 miles in Campbell County, and 4 miles in Pendleton County. This tornado caused extensive damage to structures and trees along its entire path on both sides of the Ohio River. Numerous homes were very heavily damaged or destroyed. Many homes lost their roofs, having complete exterior wall failure. Some modular homes were completely removed from their foundations, lifted, and thrown in excess of 100 yards where they were destroyed. Estimated damages from the tornado were $1,000,000.

4.14.3 Assessing Vulnerability: Tornado

Severe Winter Storm Vulnerability Score = Exposure Score + Hazard Score

Locations of tornado touch downs are difficult to predict at the county level, and even more difficult at the campus level. Because NKU does not have any recorded occurrences and the campus is relatively small, the Tornado Hazard Score is assumed to be the same for all university buildings. Therefore, the Exposure Score represents the Tornado Vulnerability Score.

Figure 4.13: Tornado Vulnerability



Sources: NKU, NCEI, ESRI

5. Capability Assessment

5.1 Introduction

The purpose of conducting the capability assessment is to determine the ability of NKU to implement a comprehensive mitigation strategy and to identify potential opportunities for establishing or enhancing specific mitigation policies, programs, or projects. As in any planning process, it is important to try to establish which goals, objectives, and/or actions are feasible based on an understanding of the organizational capacity of those departments tasked with their implementation. A capability assessment helps to determine which mitigation actions are practical, and likely to be implemented over time, given the university's planning and regulatory framework, level of administrative and technical support, amount of fiscal resources, and current political climate.

The capability assessment has two components: 1) an inventory of the university's relevant plans, ordinances, or programs already in place and 2) an analysis of its capacity to carry them out. Careful examination of university capabilities will detect existing gaps, shortfalls, or weaknesses with ongoing university activities that could hinder proposed mitigation activities and possibly exacerbate community hazard vulnerability. A capability assessment also highlights the positive mitigation measures already in place or being implemented by the university, which should continue to be supported and enhanced through future mitigation efforts.

The Capability Assessment completed for the NKU HMP serves as a critical planning step and an integral part of an effective hazard mitigation strategy. Coupled with the Risk Assessment, the Capability Assessment helps identify and target meaningful mitigation actions for incorporation in the Mitigation Strategy portion of this plan. Any potential shortcomings in the ability of the university to implement hazard mitigation is tied to the mitigation strategy in the form of actions selected by the planning team. It not only helps establish the goals and objectives for the university to pursue under this plan, it also ensures that those goals and objectives are realistically achievable under given local conditions. Specific recommendations for actions that will improve NKU's ability to implement the hazard mitigation plan and increase resilience are offered at the conclusion of this section.

5.2 Conducting the Capability Assessment

The Capability Assessment began with a request of pertinent plans from the Planning Team and NKU Stakeholder Group. The request asked for existing local plans, policies, programs, or ordinances related to hazard mitigation or emergency management. In addition, the Planning Team conducted interviews and conversations with key university stakeholders (Safety & Emergency Management, Facilities Management, Student Affairs, University Police, Campus Planning) to determine if there are any policies or programs that contribute to and/or hinder the university's ability to implement hazard mitigation. Understanding general university procedures is an important consideration with respect to hazard mitigation implementation.

At a minimum, results provide an extensive inventory of existing campus plans, policies, programs, and resources that are in place or under development in addition to their overall effect on hazard loss reduction. However, the information can also serve to identify gaps, weaknesses, or conflicts that the university can recast as opportunities for specific actions to be proposed as part of the mitigation strategy.

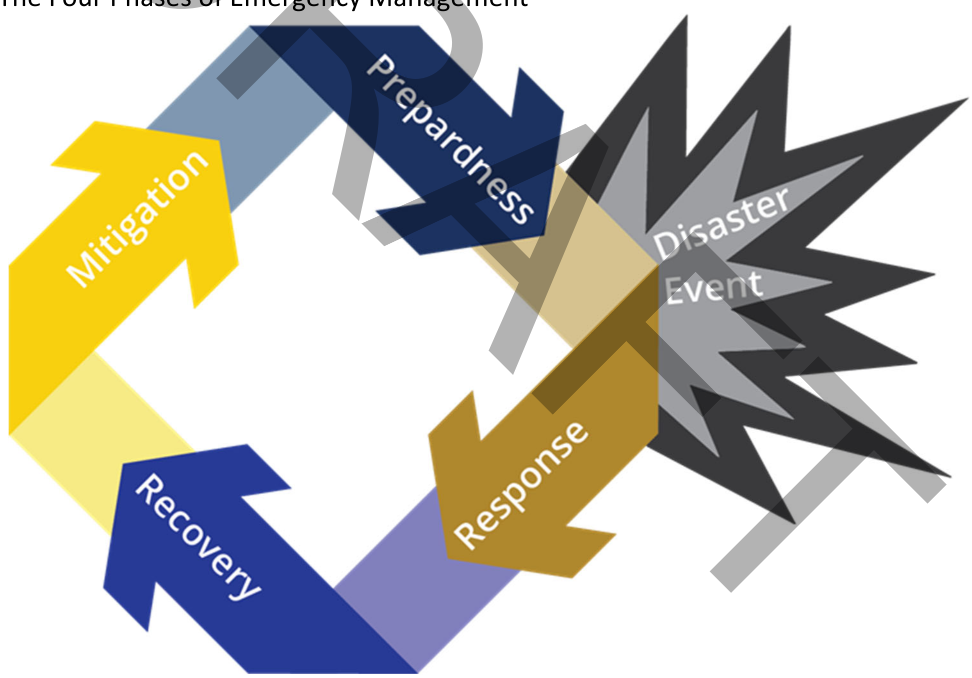
The results of this Capability Assessment provide critical information for developing an effective and meaningful mitigation strategy.

Emergency Management

Hazard mitigation is widely recognized as one of the four primary phases of emergency management. The three other phases include preparedness, response, and recovery. Each phase is interconnected, as Figure 5.1 illustrates. Opportunities to reduce potential losses through mitigation practices are often implemented before a disaster event strikes, such as flood-proofing of flood prone structures, installing back-up power sources, or enhancing security measures. Mitigation opportunities will also be presented during immediate preparedness or response activities, such as activating emergency response teams prior to severe storms, and certainly during the long-term recovery and redevelopment process following a hazard event.

Planning for each phase is a critical part of a comprehensive emergency management program and a key to the successful implementation of hazard mitigation actions. As a result, the Capability Assessment will assess the university's willingness to plan and their level of technical planning proficiency.

Figure 5.1: The Four Phases of Emergency Management



Hazard Mitigation Plan - A hazard mitigation plan represents a community's blueprint for how it intends to reduce the impact of natural and human-caused hazards on people and the built environment. The essential elements of a hazard mitigation plan include a Risk Assessment, Capability Assessment, and Mitigation Strategy. This plan is NKU's first stand-alone hazard mitigation. In previous years, the university participated in and was included in the Northern Kentucky Regional Natural Hazard Mitigation Plan. Because the universities are classified as a local government, they are eligible for all hazard mitigation funding and education programs administered by the State.

Disaster Recovery Plan - A disaster recovery plan serves to guide the physical, social, environmental, and economic recovery and reconstruction process following a disaster. In many instances, hazard mitigation principles and practices are incorporated into local disaster recovery plans with the intent of capitalizing on opportunities to break the cycle of repetitive disaster losses. Disaster recovery plans can also lead to the preparation of disaster redevelopment programs and projects to be enacted following a hazard event. The university has not yet adopted a disaster recovery plan.

Emergency Operations Plan - The Emergency Operations Plan (EOP) provides a framework which the university will use to respond to events creating major disruptions to the ordinary operations of the university. The purpose of the plan is to guide university officials in their efforts to minimize the impact of such events and return to routine operations as soon as possible. Activation of the plan is at the direction of the University President, or his designee.

In addition to the EOP, NKU publishes an Emergency Guide on its website. The Emergency Guide includes information on who to contact and where to get information during a variety of emergency events, as well as guidance on what to do in case of an event. The Guide also includes an overview of building evacuation and shelter in place procedures.

In addition to the EOP, NKU publishes an Emergency Guide in its website. The Emergency Guide includes contact information for who to contact and where to get information during a variety of emergency events, as well as guidance on what to do in case of an event. The Guide also includes an overview of building evacuation and shelter in place procedures.

Emergency Communication - NKU uses NORSE ALERT, an email, phone and text message service to communicate with the campus community in the event of an emergency or campus closing. All NKU students, staff, and faculty are automatically registered in NORSE ALERT with their official university e-mail address. Students, staff, and faculty are encouraged to add other contact information, such as mobile numbers and personal e-mails, to their NORSE ALERT accounts. The campus is also equipped with a public address system comprised of speaker systems throughout the buildings and five outdoor speaker arrays. The system uses tones and pre-recorded announcements and is activated by University Police in the event an immediate threat to the campus community.

Norse Alert and the public address system are tested twice a year on the second Wednesday of the spring and fall semesters. During the most recent test, conducted on January 23, 2019, there were approximately 20,500 users registered. Ninety percent of the messages were delivered within two minutes and 55 seconds.

Planning and Regulatory Capability

Planning and regulatory capability is based on the implementation of plans, policies, and programs that demonstrate the university's commitment to guiding and managing growth, while maintaining the general welfare of the community. It includes emergency response and mitigation planning, master planning, capital planning, and enforcement of design and construction standards. Although conflicts can arise, these planning initiatives present significant opportunities to integrate hazard mitigation principles into the university decision making process.

This assessment is designed to provide a general overview of key planning tools and programs at NKU along with their potential effect on hazard mitigation. This information will help identify opportunities to address existing gaps, weaknesses, or conflicts with other initiatives in addition to integrating the implementation of this Plan with existing planning mechanisms where appropriate.

The implementation of hazard mitigation activities often involves departments and individuals beyond the emergency management profession. Stakeholders may include department chairs/directors, building managers, and administrators. In many instances, concurrent planning efforts will help to achieve or complement hazard mitigation goals, even though they are not designed as such. Therefore, the Capability Assessment also included general planning capabilities and the degree to which hazard mitigation is integrated into other on-going planning efforts.

Campus Master Plan - A campus master plan establishes the overall vision for what a university wants to be and serves as a guide for future campus facilities. Typically, a master plan determines the need for and location of new facilities and open space. The current NKU Master Plan was completed in 2009. The plan provides a comprehensive framework for achieving a distinctive and desirable learning environment with ample future physical growth capacity. Northern Kentucky University considers storm water management a very important issues since the campus is growing. This growth translates into more impervious surfaces. The plan sets aside a significant amount of land to accommodate rain water runoff. The techniques recommended include rain gardens, swales, drainage ways, and retention basis. For the retention stormwater there are natural ponds and wetlands as designated areas distributed across campus. Swales are to be located along road edges and parking lots. The areas of Academic Core, North Village, South Campus, and South Village are the areas of major human and building density.

Capital Improvements – On a biennial basis, NKU is required to prepare a Six Year Capital Plan and from that document, a Biennial Capital Budget. Both documents are submitted to the Council on Postsecondary Education as well as state government and represent the university’s state funding request for capital improvements.

Currently, the 2018-2020 project list includes several projects that relate to hazard mitigation that could possibly receive full or partial funding from FEMA Hazard Mitigation Assistance programs.

- Replace Underground Gas Mains
- Replace Water and Sewer Mains
- Enhance/Upgrade Cyber Security System
- Campus Telecommunications Upgrade

Other projects may receive FEMA funding for portions of the project that directly relate to hazard mitigation.

Building Design Guidelines – In 2014, NKU adopted version six of its Design and Construction Standards to apply to all renovation and new construction projects. The guidelines include a requirement that all new buildings will meets LEED certification standards and that they follow the design guidelines outlines in the NKU Master Plan, which address energy use and stormwater management.

Fiscal Capability

The ability of a university to act is closely associated with the amount of fiscal resources available to implement policies and projects. This may take the form of outside grant funding awards or university-based revenue and financing. The cost of mitigation policy and project implementation vary widely. In some cases, policies are tied primarily to staff time or administrative costs associated with creation and monitoring of a given program. In other cases, direct expenses are linked to an actual project, such as installing back-up power generators or storm shelters, which can require a substantial commitment from university, state, and federal funding sources. The university has made fiscal commitments to the mitigation of hazards and security of the population to date. This hazard mitigation plan provides a foundation to plan for future needs as well.

Political Capability

One of the most difficult capabilities to evaluate involves the political will of a university to enact meaningful policies and projects designed to reduce the impact of future hazard events. The political climate must be considered in designing mitigation strategies as it could be the most difficult hurdle to overcome in accomplishing their adoption and implementation. NKU officials have repeatedly emphasized the need and desire for a safe, secure campus, and their completion of the hazard mitigation plan is one such commitment to this effort.

5.3 Conclusion on Campus Capability

A Capability Assessment examines university capabilities to detect any existing gaps or weaknesses within ongoing activities that could hinder proposed mitigation activities and possibly exacerbate community hazard vulnerability. A few gaps or weaknesses were identified for NKU through an examination of existing plans and programs and conversations with university staff and administrations. The conclusions of the Risk Assessment and Capability Assessment serve as the foundation for the development of a meaningful hazard mitigation strategy. The list below outlines key capabilities NKU can address in the Mitigation Strategy:

- Conduct annual emergency exercises to make sure EOP is current;
- Develop a formal continuity of operations plan;
- Develop overall campus evacuation plan;
- Create building incident response teams and provide regular training;
- Enhance communications abilities before and during a disaster event; and
- Integrate mitigation actions into capital improvement program.

6. Mitigation Strategy

The intent of the Mitigation Strategy is to provide NKU with the goals that will serve as guiding principles for future mitigation policy and project administration along with an analysis of mitigation actions deemed obtainable to meet those goals and reduce the impact of identified hazards. It is designed to be comprehensive, strategic, and functional in nature:

- In being *comprehensive*, the development of the Mitigation Strategy includes a thorough review of all hazards and identifies extensive mitigation measures intended to not only reduce the future impacts of hazards, but also to help the university achieve compatible economic, environmental, social, and security goals.
- In being *strategic*, the development of the Mitigation Strategy works to align proposed policies and projects with pre-identified, long-term planning goals.
- In being *functional,* each proposed mitigation action is linked to established priorities and assigned to specific divisions, departments, or individuals responsible for their implementation with target completion deadlines. When available, funding sources are identified that can be used to assist in project implementation.

The first step in designing the Mitigation Strategy includes the identification of mitigation goals. Mitigation goals represent broad statements that are consistent with the hazards identified within the plan and achieved through the implementation of more specific mitigation actions. These goals set the blueprint for the Mitigation Strategy and allowed the stakeholders to vision what they wanted to achieve over the next five-year period.

The second step involves the identification, consideration, and analysis of available mitigation measures (i.e., activities, policies, etc.) that lead to identifying mitigation actions that will help achieve the identified mitigation goals. This is a long-term, continuous process sustained through the development and maintenance of this plan. Alternative mitigation measures will continue to be considered as future mitigation opportunities are identified, as data and technology improve, as mitigation funding becomes available, and as this plan is maintained over time.

The third and last step in designing the Mitigation Strategy is the development of the Mitigation Action Plan. The Mitigation Action Plan represents a comprehensive and functional plan for each action and is the most essential outcome of the mitigation planning process. The Mitigation Action Plan includes a prioritized listing of proposed hazard mitigation actions (policies and projects) for the university to complete. Each action has accompanying information, such as those departments or individuals assigned responsibility for implementation, potential funding sources, and an estimated target date for completion. The Mitigation Action Plan provides those departments or individuals responsible for implementing mitigation actions with a clear roadmap that also serves as an important tool for monitoring success or progress over time. The cohesive collection of actions listed in the Mitigation Action Plan can also serve as an easily understood menu of mitigation policies and projects for those local decision makers who want to quickly review the recommendations and proposed actions of the Plan and potentially integrate with other planning documents.

In preparing the Mitigation Action Plan, members of the NKU Stakeholder Group and Planning Team considered the overall hazard risk and capability to mitigate the effects of hazards as recorded through the risk and capability assessment process. The adopted mitigation goals were also considered when developing each action item.

Developing the 2018 Mitigation Strategy
As this is the university's first hazard mitigation plan, the Mitigation Strategy was developed through a process with the Planning Team and NKU Stakeholder Group in a manner that followed a traditional format.

- Identify Goals
- Identify Actions
- Develop a Mitigation Action Plan

6.1 Mitigation Goals

The NKU Stakeholder Group agreed on the following goals to guide development and implementation of the plan's mitigation actions:

1. *Pursue consistent funding from a variety of sources for prevention, maintenance, and mitigation of disasters;*
2. *Increase public and university awareness through education and support for disaster preparedness practices;*
3. *Enhance staff capacity and collaboration, policies, and technical capabilities that will mitigate and reduce damages from hazard events;*
4. *Protect university property, organizational information, and research assets from hazards and threats;*
5. *Build and sustain partnerships between government, educational institutions, business, and the community; and*
6. *Protect lives and minimize injuries that could be caused by hazard events.*

6.2 Mitigation Actions

A wide range of activities were considered to help advance NKU's new mitigation goals, in addition to addressing any specific hazard concerns. To help the university community and NKU Stakeholder Group understand what mitigation activities to consider, the Planning Team presented the following six broad categories of mitigation techniques: Prevention, Property Protection, Natural Resource Protection, Structural Projects, Emergency Services, and Public Awareness and Education. Presenting mitigation activities examples under these category types helped the decision makers understand the kinds of activities addressed under a Hazard Mitigation Plan. The following provides example activities presented under each category:

Prevention
Preventative activities are intended to keep hazard problems from getting worse and are typically administered through government programs or regulatory actions that influence the way land is developed and buildings are built. They are particularly effective in reducing a community's future vulnerability, especially in areas where development has not occurred, or capital improvements have not been substantial. Examples of preventative activities include:

- Planning and zoning
- Building codes
- Open space preservation
- Floodplain regulations

Property Protection
Property protection activities involve the modification of existing buildings and structures to help them better withstand the forces of a hazard, or removal of the structures from hazardous locations. Examples include:

- Acquisition
- Relocation
- Building elevation
- Critical facilities protection

Natural Resource Protection
Natural resource protection activities reduce the impact of natural hazards by preserving or restoring natural areas and their protective functions. Such areas include floodplains, wetlands, and steep slopes. Parks, recreation, or conservation agencies and organizations often implement these protective measures. Examples include:

- Floodplain protection
- Watershed management
- Riparian buffers
- Forest and vegetation management (e.g., fire resistant landscaping, fuel breaks, etc.)

Structural Projects
Structural mitigation activities are intended to lessen the impact of a hazard by modifying the environmental natural progression of the hazard event through construction. They are usually designed by engineers and managed or maintained by public works staff. Examples include:

- Reservoirs
- Dams / levees / dikes / floodwalls
- Diversions / detention / retention
- Channel modification
- Storm sewers
- Storm Shelters
- Shatter proof windows

Emergency Services
Although not typically considered a "mitigation" technique, emergency service activities do minimize the impact of a hazard event on people and property. These commonly are actions taken immediately prior to, during, or in response to a hazard event. Examples include:

- Warning systems
- Evacuation planning and management

- Emergency response training and exercises
- Sandbagging for flood protection
- Installing temporary shutters for wind protection

Public Education and Awareness

Public education and awareness activities are used to advise residents, elected officials, business owners, potential property buyers, and visitors about hazards, hazardous areas, and mitigation techniques they can use to protect themselves and their property. Examples of measures to educate and inform the public include:

- Outreach projects
- Speaker series / demonstration events
- Hazard map information
- Real estate disclosure

To develop NKU's Mitigation Action's, a Mitigation Action Workbook was developed and provided to members of the NKU Stakeholder Group. Specific instructions were provided to help committee members generate ideas for new actions. The instructions document may be found in Appendix E.

At the September 27, 2018 Mitigation Strategy meeting the Mitigation Strategy feedback was reviewed and additional comments were captured. After this meeting the Planning Team put together the final 2018 Mitigation Action Workbook and prioritized the actions.

Mitigation Action Prioritization

Mitigation action prioritization emphasizes the extent to which benefits are maximized, according to a review of the proposed projects potential benefits and their associated costs. Through the Benefit-Cost Prioritization Matrix (Figure 6.1), the higher the action's benefit, and the lower the cost, the more cost beneficial and higher priority the action was determined to be for the LFUCG community.

The benefit scale is based on using a simplified version of FEMA's Mitigation Action Evaluation Worksheet (see Appendix F). For each Action, the Planning Team identified the potential benefits using the following criteria as laid out in the Mitigation Action Evaluation Worksheet.

- Enhance Life Safety
- Protect Property
- The Action is Technically Feasible
- The Action is Political Feasible
- The Action is Legal
- Positive Environmental Impacts
- Positive Social Impact
- Administrative Capability
- Local Champion
- The Action Advances Other Community Objectives

The Planning Team using the criteria described above ranked each action's potential benefit as "very high," "high," "moderate," or "low". This information provided the benefit variable for the Benefit Cost Prioritization Matrix and methodology.

Next, the Planning Team using information captured at the Mitigation Strategy meeting and the Mitigation Action Workbook exercise determined rough cost estimates that were scored based on which category they fell within.

- Low Estimated Cost ($0 - $4,999)
- Moderate Estimated Cost ($5000 - $49,999)
- High Estimated Cost ($50,000 - $249,999)
- Very High Estimated Cost ($250,000 - Above)

Once the general benefit and cost of the project was determined, the Planning Team determined the priority of each action item based on a Benefit Cost Prioritization Matrix (Figure 6.2). This simplified decision-making chart, uses rough cost estimations and the mitigation benefit evaluation variables to assign a prioritization ranking for each action item. Action items that receive a higher-ranking signal projects that could need special attention. Inversely, projects that are estimated to be higher in cost with a lower benefit receive a lower ranking. It is important to note that this Benefit Cost methodology is to be used as a first pass screening tool. This methodology provides a simplistic Benefit-Cost model and depending on the action item a more detailed Benefit-Cost model maybe needed in the future.

Figure 6.2: Benefit-Cost Prioritization Matrix

Prioritization Matrix					
		Benefit			
		D (Low)	**C (Moderate)**	**B (High)**	**A (Very High)**
Estimated Cost	**Very High**	Low	Low	Medium	High
	High	Low	Medium	Medium	Very High
	Moderate	Low	High	High	Very High
	Low	Medium	High	Very High	Very High

The NKU Stakeholder Group identified 41 mitigation actions that address all 11 identified hazards. Several actions address multiple hazards and some address all hazards. Within the Action Workbook each hazard is categorized under the six broad categories of mitigation techniques: Prevention, Property Protection, Natural Resource Protection, Structural Projects, Emergency Services, and Public Awareness and Education. Each mitigation action is also numbered under those categories (Emergency Services 1.1, 1.2; Prevention 2.1,2.2 etc.).

The following key elements are captured within the 2019 Mitigation Action Workbook to help NKU track each action over the next five years.

- Action Number
- Action Description
- Hazard(s) Addressed
- Type of Action
- Estimated Cost
- Benefits
- BC Prioritization
- Potential Funding Sources/Considerations
- Lead implementor and other Partners
- Timeframe

6.3 Mitigation Action Plan

Action Number	Action Description	Hazard(s) Addressed	Type	Estimated Cost	Benefits	BC Prioritization	Potential Funding Sources	Lead Implementer and other Partners	Timeframe
1.1	Maintain equipment and supplies for the Data Center and Building Data Closets	All-hazards	Emergency Services	$50,000 - $249,999 (High)	High	Moderate	Departmental	IT	Annually
1.2	Maintain redundant fiberoptic communication infrastructure	All-hazards	Emergency Services	$50,000 - $249,999 (High)	High	Moderate	Internal, Departmental	IT	Annually
1.3	Develop cellular-based wireless connectivity for each building	All-hazards	Emergency Services	$50,000 - $249,999 (High)	High	Moderate	Internal, Departmental, Grant	IT	2-4 years
1.4	Install infrastructure at critical buildings to allow quick connect to mobile generators if needed	All-Hazards	Emergency Services	$250,000 – Above (Very High)	Moderate	Low	Grant, Internal	Facilities Management	5 years
1.5	Install signs identifying evacuation routes and emergency shelter areas	All-Hazards	Emergency Services	$0 - $4,999 (Low)	Moderate	High	Internal	Facilities Management	1 year
1.6	Establish satellite phone service for key personnel to use as backup communications in event a disaster disables normal phone services	All-Hazards	Emergency Services	$0 - $4,999 (Low)	Moderate	High	Grant, Internal	Safety and Emergency Management	5 years
1.7	Develop university business continuity contingency plan	All-Hazards	Emergency Services	$5,000 – $49,999 (Moderate)	Moderate	High	Departmental	Safety and Emergency Management	2-3 years
1.8	Purchase and install emergency generator for at least one food service location	All-Hazards	Emergency Services	$50,000 - $249,999 (High)	Moderate	Moderate	Grant, Internal	Business Auxiliary Services, Facilities Management	2 years

Action Number	Action Description	Hazard(s) Addressed	Type	Estimated Cost	Benefits	BC Prioritization	Potential Funding Sources	Lead Implementer and other Partners	Timeframe
1.9	Provide emergency generator power to IT infrastructure and IT closets	All-Hazards	Emergency Services	$50,000 - $249,999 (High)	Moderate	Moderate	Grant, Internal	IT, Facilities Management	3 years
1.1	Provide backup HVAC units for maintaining building habitability in event of power outage or damage to physical heating plant	Extreme Heat, Extreme Cold, Severe Storm, Severe Winter Storm, Tornado	Emergency Services	$50,000 - $249,999 (High)	Moderate	Moderate	Grant, Internal	University Housing, Facilities Management	5 years
1.11	Develop Building Emergency Action Plans for all university buildings.	All-Hazards	Emergency Services	Staff Time (Low)	Moderate	High	Internal, External	Safety and Emergency Management	2 years
1.12	Upgrade and maintain DR equipment at off-site location	All-hazards	Emergency Services	$250,000 – Above (Very High)	Very High	High	Internal, Grant	IT	1 year
1.13	Reinforce and maintain the area around the core network	All-hazards	Emergency Services	$250,000 – Above (Very High)	Very High	High	Internal, Departmental	IT	Annually
1.14	Provide necessary food, water, and first-aid supplies to campus buildings for shelter-in-place events	All-Hazards	Emergency Services	$5,000 – $49,999 (Moderate)	Very High	Very High	Internal, Grant	Safety and Emergency Management	Annually
1.15	Maintain equipment and supplies for the Emergency Operations Center	All-hazards	Emergency Services	$50,000 - $249,999 (High)	Very High	Very High	Internal, Grant	IT	1 - 2 years

Action Number	Action Description	Hazard(s) Addressed	Type	Estimated Cost	Benefits	BC Prioritization	Potential Funding Sources	Lead Implementer and other Partners	Timeframe
2.1	Information Security Incident Response Policy	Protection of Data	Prevention	$0 - $4,999 (Low)	High	Very High	Departmental	IT	1 year
2.2	Protect data/communications network from various cyberthreats to ensure integrity and usefulness during natural disaster event	All-Hazards	Prevention	$5,000 – $49,999 (Moderate)	High	High	Internal	All network users; IT lead	Annually
2.3	Ensure "bring-your-own-devices" connecting to NKU network are protected with anti-virus software	Protection of data	Prevention	Staff Time (Low)	high	Very High	Internal	All network users; IT lead	1 year
2.4	Complex passwords/Combine as a Data Security	All-Hazards	Prevention	Staff Time (Low)	High	Very High	Internal, Departmental	IT	Annually
2.5	Provide emergency generator power to IT infrastructure	All-Hazards	Prevention	Staff Time (Low)	High	Very High	Grant, Internal	IT	2 years
2.6	Investigate whether upgrades to the existing CCTV system would improve campus security and communications in the event of a natural disaster		Prevention	Staff Time (Low)	Low	Very High	Grant, Internal	Safety and Emergency Management	2 years
2.7	Leverage Safe Colleges Tool for Information Security Training and Accessibility	Protection of data	Prevention	$5,000 – $49,999 (Moderate)	Very High	Very High	Grant, Internal	HR/IT/Facilities	Annually
2.8	External Security Audit	Protection of Data	Prevention	$50,000 - $249,999 (High)	Very High	Very High	Departmental	IT	Annually

Action Number	Action Description	Hazard(s) Addressed	Type	Estimated Cost	Benefits	BC Prioritization	Potential Funding Sources	Lead Implementer and other Partners	Timeframe
3.1	Biannual Tabletop DR Exercises	All-hazards	Property Protection	$0 - $4,999 (Low)	High	Very High	Internal	IT	Bi-annual
3.2	External WAP's in protective enclosures	All-hazards	Property Protection	$5,000 – $49,999 (Moderate)	High	High	Internal	IT	1 year
3.3	Develop and implement procedures for protecting/relocating research animals and materials which will preserve data and maintain applicable grant and research protocols	All-Hazards	Property Protection	$5,000 – $49,999 (Moderate)	High	High	Internal, Departmental	Facilities Management	2 years
3.4	Develop and implement protocols and storage facilities for hazardous materials involved in laboratory research	HAZ/MAT	Property Protection	$5,000 – $49,999 (Moderate)	High	Moderate	Internal, Departmental, Grant	Facilities Management	1-2 years
3.5	Improve system infrastructure to limit vulnerabilities (up to date on patches, removal of login credentials when staff leave positions, etc.)	All-hazards	Property Protection	Staff Time (Low)	High	Very High	Internal	IT	Ongoing, or As Needed
3.6	Have faculty and staff use OneDrive for storage	Earthquake, Extreme Heat, Flood, Severe Storm, Severe Winter Storm, Tornado	Property Protection	Staff Time (Low)	High	Very High	Departmental, Internal	All departments; IT lead	1 year

Action Number	Action Description	Hazard(s) Addressed	Type	Estimated Cost	Benefits	BC Prioritization	Potential Funding Sources	Lead Implementer and other Partners	Timeframe
3.7	Business Academic Center "core network" needs redundant/backup power supply and other protection similar to Admin data center		Property Protection	$5,000 – $49,999 (Moderate)	Moderate	High	Internal, Grant	Business Auxiliary Services, Facilities Management	2-4 years
4.1	Develop additional educational programs to inform students, faculty and staff on what to do during emergencies	All-Hazards	Public Education and Awareness	$0 - $4,999 (Low)	High	Very High	Grant, Internal	Safety and Emergency Management, Human Resources, Provost	1 year
4.2	Integrate existing digital signs to communicate hazard warnings	All-Hazards	Public Education and Awareness	$5,000 – $49,999 (Moderate)	High	High	Internal	IT, Emergency Management	1 year
4.3	Increase website, or IT Service Catalog presence for Security and Disaster Recovery information	All-hazards	Public Education and Awareness	Staff Time (Low)	High	Very High	Internal	IT	Ongoing, or As Needed
4.4	Improve IT crisis communication and emergency response plan	All-hazards	Public Education and Awareness	Staff Time (Low)	High	Very High	Departmental. Internal	All departments; IT lead	1 year
4.5	Develop campaign for awareness of Norse Alert/emergency education and awareness	All-Hazards	Public Education and Awareness	$0 - $4,999 (Low)	Moderate	High	Internal, External	MarCom, Safety and Emergency Management	2 years

Action Number	Action Description	Hazard(s) Addressed	Type	Estimated Cost	Benefits	BC Prioritization	Potential Funding Sources	Lead Implementer and other Partners	Timeframe
5.1	Secure funding for new police department and emergency operations center	All-Hazards	Structural Projects	$250,000 – Above (Very High)	High	Very High	Grant, Internal, External	University Police, Facilities Management	2 years
5.2	Upgrade data backup equipment and infrastructure to ensure continued service/safety of data	All-Hazards	Structural Projects	$5,000 – $49,999 (Moderate)	High	High	Internal, Departmental	All network users; IT lead	1-2 years
5.3	Stormwater management improvements across campus including flooding alarms, system maintenance protocols, and emergency pumps for vulnerable manholes and underground facilities	Flood	Structural Projects	$50,000 - $249,999 (High)	High	Very High	Internal, Grant, External	Facilities Management	5 years
5.4	Install alternate fire suppression system in archives storage	All-Hazards	Structural Projects	$50,000 - $249,999 (High)	Moderate	Moderate	Grant, Internal	Facilities Management, Library	5 years
5.5	Install EMP lightning protection on campus	Severe Storms, Tornado	Structural Projects	$250,000 – Above (Very High)	Very High	High	Internal, Grant	Facilities Management	5 years
5.6	Install storm protection rooms in Housing facilities and other designated buildings	Severe Storms, Tornado	Structural Projects	$50,000 - $249,999 (High)	Very High	Very High	Grant	University Housing, Facilities Management	5 years

7. Plan Maintenance

Per DMA 2000 guidance, hazard mitigation plans must layout a plan maintenance process that highlights how the jurisdiction will monitor and evaluate the plan over the next five years. One must also consider how the plan will be incorporated into existing and future planning mechanisms and finally consider how the jurisdiction will continue public involvement.

The process of maintaining the HMP will provide NKU the opportunity to document progress in achieving mitigation goals. The planning team agreed that it is imperative to have stakeholder involvement for continuing the plan maintenance process and to ensure the mitigation strategy is implemented through university programs and regulations.

Plan Maintenance Procedures

Requirement §201.6(c)(4) requires a formal plan maintenance process to ensure that the Mitigation Plan remains an active and relevant document. The plan maintenance process must include a method and schedule for monitoring, evaluating, and updating the plan at least every five years.

This section must also include an explanation of how local governments intend to incorporate their mitigation strategies into any existing planning mechanisms they have, such as comprehensive or capital improvement plans, or zoning and building codes. Lastly, this section requires that there be continued public participation throughout the plan maintenance process.

7.1 Monitoring, Evaluation, and Updates

NKU Safety and Emergency Management will be the primary point of contact and will coordinate all university efforts to monitor and evaluate the plan. NKU proposes an attainable and standardized process for maintaining the plan document through the annual monitoring of the Mitigation Action Plan, and annual progress reporting with the NKU Stakeholder Group and Planning Team. The annual progress monitoring will also assist with the incorporation of plan maintenance procedures into other planning mechanisms at the university. Annually tracking of the implementation of the plan and the mitigation actions will be the lead responsibility of NKU Safety and Emergency Management.

In order to allow NKU Safety and Emergency Management to track and monitor plan maintenance a set schedule of annual meetings will be put into place. The first meeting will be held one year from the adoption of the HMP.

In addition, NKU will use several tools to manage the monitoring and evaluation of the HMP. To track annual progress the Planning Team has developed two plan maintenance forms/reports (Appendix G). The first one is an individual project progress report form that will be completed by the appropriate NKU Stakeholder Group members and appropriate agencies and submitted to NKU Safety and Emergency Management on an annual basis. These reports are designed to allow responsible agencies and organizations the ability to list successes and/or potential issues with implementing responsible action items within the Mitigation Action Plan. In addition, a plan amendment form was developed to track potential changes to the plan itself, prior to the next 5-year update. These forms will be used by the NKU Safety and Emergency Management to help maintain the progress of the plan over the next 5-years and be used when updating the 2024 Hazard Mitigation Plan. The continuous monitoring and formalized annual review will serve as the basis for a brief annual report, which will be completed one-year post plan adoption.

Furthermore, the NKU Safety and Emergency Management will use the Mitigation Action Workbook to evaluate the status of the mitigation actions identified in section 6.3. The Mitigation Action Workbook will be a live document living outside of the plan and being tracked through an excel spreadsheet format. The Mitigation Action Workbook excel file looks just like the table found in section 6.3 but has one additional column that allows the NKU Safety and Emergency Management office to add comments into the spreadsheet for mitigation action monitoring and evaluation purposes.

Through the completion of annual meetings with the NKU Stakeholder Group and the tools described above the NKU Safety and Emergency Management office will have the tools to create an annual report that will help make the plan update process run more smoothly.

Lastly, NKU Safety and Emergency Management will also utilize Kentucky's Community Hazard Assessment and Mitigation Planning System (CHAMPS) to track mitigation strategies and apply for HMGP funding when it becomes available.

7.2 Incorporation into Existing Planning Mechanisms

NKU will integrate the 2019 LFUCG NKU HMP into relevant university policies, plans, or mechanisms, where feasible. This includes integrating the requirements of the HMP into other university planning documents, processes, or mechanisms, such as capital improvement plans, emergency operation plans, IT disaster plans, and others when appropriate.

During the review, updating, and standard enforcement of the existing university authorities and programs, mitigation actions listed in this plan will be incorporated, implemented, and enforced. In addition, the members of the NKU Stakeholders Group will ensure the goals and mitigation actions of new and updated university planning documents for their offices and departments are consistent, or do not conflict with, the goals and actions of the NKU HMP. Lastly, this process has educated the NKU Stakeholder Group on the importance of hazard mitigation and will serve as the spear to lessen hazard vulnerability within NKU.

7.3 Continued Public Involvement

NKU Safety and Emergency Management and the NKU Stakeholder Group are dedicated to continuing public involvement in the plan and the mitigation actions that will be implemented. This plan has been created with significant input with representation across and beyond the university and the main goal is to provide opportunities on a regular basis to facilitate continued university community involvement.

During the annual reporting process, NKU Safety and Emergency Management will engage the public and give the chance to provide feedback. The annual Hazard Mitigation Plan Maintenance meeting will be advertised through the NKU Safety and Emergency Management website and be open to the public.

In addition to public involvement in the annual progress report process, NKU Safety and Emergency Management will continually inform and reach out to the public through social media and by participating in university events to share the message of mitigation. The NKU Hazard Mitigation Plan will be placed on NKU's Hazard Mitigation website for continued sharing of the plan

(https://inside.nku.edu/safety/emergencymanagement/hazardmitigation.html)

8. Plan Adoption

Adoption by the local governing body demonstrates a commitment to fulfilling the hazard mitigation goals and actions outlined in the plan. The local jurisdiction submitting the plan must satisfy the plan adoption prerequisite before the plan can be approved by FEMA.

The plan was formally adopted by the Northern Kentucky President on xxx (Appendix A). The endorsement of this plan demonstrates Northern Kentucky University's commitment to fulfilling the mitigation objectives outlined in the plan. It also legitimizes the plan and authorizes the responsible agencies identified in the plan to execute their responsibilities.

Local Mitigation Plan Prerequisites

§201.6(c)(5): [The local hazard mitigation plan shall include] documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan (e.g., City Council, County Commissioner, Tribal Council).

The plan submittal process began with NKU Safety and Emergency Management submitting the plan to the Kentucky Emergency Management (KyEM) for review and comment and then incorporating any revisions. KyEM then submitted the plan to FEMA Region IV for approval, pending local adoption status. Please see Appendix H for approved Local Mitigation Plan Review Tool.

9. Appendices

Appendix A: Plan Adoption Letter

Appendix B: Stakeholder/Public/Planning Team Meeting Materials

The following information is broken down for each of the four Stakeholder Meetings:

- Agendas
- Invites
- Sign-In
- Notes

Stakeholder Kick-Off Meeting
March 20, 2018
1:00pm - 3:00pm

Agenda	
Welcome	**Jeff Baker, Safety & Emergency Management**
Hazard Mitigation Planning 101	**Josh Human, Stantec**
Hazard Identification & Ranking Exercises	**John Bucher, Stantec**
Data Needs	**Josh Human, Stantec**

The hazard mitigation planning process is required under federal law to help communities better prepare for disaster events and to ensure communities are eligible for federal grants to support mitigation actions. Plans must be updated and approved every five years to maintain eligibility. This will be NKU's first hazard mitigation plan.

The completed plan will be submitted to the Kentucky Division of Emergency Management and the Federal Emergency Management Agency for approval prior to being submitted to Board of Regents for adoption.

Contacts

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John Bucher
Stantec
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502.212.5044

Data Needs - Capability and Vulnerability Assessments

The list below includes examples of the types of data we will need to complete the capability and vulnerability assessments for the Hazard Mitigation Plan. Where applicable, data should be in a GIS format.

1. **Past Presidential Disaster Declarations**
   Any information on their past presidential declarations. When they happened, what hazards were involved, how many people were affected etc.…

2. **Past Significant Hazard Events**
   - With estimated losses
   - With estimated recovery costs
   - With estimated non-recovered costs
   - Locations of past hazard events

3. **Community Profile & Capabilities**
   - Population composition
   - Community history
   - Population growth trends/rates
   - Land area and Geography
   - Climate
   - Land Use trends
   - Housing composition
   - Economic makeup
   - Transportation corridors (HAZ/MAT)
   - Related plans, initiatives, and policies
   - Staff with related responsibilities
   - Completed mitigation actions and related projects (planning, development, capital improvement)

4. **Critical or Vulnerable Facilities**
   - Residence Halls
   - Student Health
   - University Police
   - Emergency Operations Center
   - Storm Shelters
   - Dining Hall
   - Research labs & Haz/Mat sites
   - Academic and Administration buildings
   - Assembly areas
   - IT and Data centers
   - Library and archives
   - Fuel storage

5. **Infrastructure & Property Data**
   - University property & structures
   - Building values/replacement costs
   - Building content values
   - Building occupancy
   - Building condition
   - Back-up power generation
   - Roads
   - Utilities
     - Sewer treatment sites
     - Water pumping stations
     - Electric generation and/or transmission
     - All lines/pipelines

YOU ARE INVITED TO ATTEND

STAKEHOLDER GROUP MEETING ON MARCH 20, 2018

NORTHERN KENTUCKY UNIVERSITY

DEVELOPMENT OF ALL HAZARDS MITIGATION PLAN

NKU Safety and Emergency Management will host the first stakeholder group meeting to create an All Hazards Mitigation Plan. This process will help the university better prepare for natural and man-made disaster events.

The meeting will be held at
Student Union
Room 109
1:00 p.m. to 3:00 p.m. on Tuesday, March 20, 2018

Presentations and handouts will be provided to attendees to explain the planning process and how the university community and local agencies can aide in data collection and hazard identification. Safety and Emergency Management has hired Stantec Consulting to assist with the creation of the university plan and has convened a Steering Committee to oversee plan development during a 9-month timeframe.

To help us be better prepared for a university disaster, it is important that our community develop a strategy to mitigate losses. The plan will outline areas that are at-risk on campus and determine vulnerabilities. The objective is to develop a program of activities to mitigate the university's vulnerability to natural and man-made hazards that NKU will adopt.

For More Information Contact:
Jeff Baker at NKU Safety and Emergency Management
(859)572-6522, bakerje@nku.edu

NKU 2018 Hazard Mitigation Plan Stakeholder Kick-Off Meeting

NKU 2018 Hazard Mitigation Plan / Stakeholder Kick-Off Meeting

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Date/Time:	March 20, 2017 / 1:00 pm
Place:	NKU Campus -
Next Meeting:	Next Meeting Date
Attendees:	29
Absentees:	Absentees
Distribution:	Distribution List

Jeff Baker, NKU Safety and Emergency Manager started the meeting by briefly explaining the benefits of having a Hazard Mitigation Plan in place. The emphasis was place of the availability of federal funds through a federal grant where the federal government offers 75 %, the state offers 13% and the university is responsible for 12% for hazard mitigation projects. Jeff Baker mentioned that in December NKY put out a Request for Proposal to presented Stantec as the selected consulting firm to update and develop the NKU 2018 Hazard Mitigation Plan. Jeff baker Introduced Josh Human, John Bucher and Luisa Trujillo from Stantec.

Josh Human, Senior Hazard Mitigation and Resilience Leader at Stantec proceeded to give a presentation about Hazard Mitigation Planning. First, he emphasized the importance for a university to have a Hazard Mitigation Plan in place especially at the present time with the amount of disasters that have happened and the government fund availability. Josh asked the audience to introduce themselves.

Among the attendants, there were a group of campus key figures including the Manager for Research Compliance and Biosafety, the Student Enrollment Coordinator, the Business and IT Manager, the Facilities Manager, the Sustainability Coordinator, and the Insurance Claims Assessor. Additionally, some authorities of the City of Highland Heights Public were also present including the Public Works Director, the Fire Chief, and the Police and First Response Lead.

Josh Human's presentation included a Hazard Mitigation 101 description, a clarification of the difference between risk and mitigation, and a detailed step by step explanation of the planning steps to complete the Hazard Mitigation Plan including Planning Process, Risk Assessment, Mitigation Strategy, Plan Maintenance and Plan Adoption. Josh Human also explained the Vulnerability Score and the tools used during the planning process.

Josh Human continued to go over each one of the hazards and ask the audience for input. Forest Wildfires, Drought and Mine Subsidence were dropped from the original list of hazards because they don't represent a risk for NKU Campus.

The Student Enrollment Coordinator inquired about how to identify sinkholes on campus. The Stantec team explained that through data analysis, it was possible determine that NKY campus is not in a sinkhole prone area. Another attendant addressed the existence of a sinkhole on campus.

Another member of the audience asked if biohazard materials such as viruses are part of the Hazard Mitigation Plan. Josh Human addressed the question by saying that this was not part of the HMP, but that some data collected and produced by the plan can be useful in biohazard projects.

Break at 2:00 pm.

After the break, Stantec's Senior Planner John Bucher introduced an activity to let the audience vote on how concerned they felt with each of the hazards. After voting, members were invited to look at three different maps where they could pinpoint exact risk locations. Voting results concluded that Severe Storms, Severe Winter Storms and Hazardous Materials are the hazards that represent the highest risk on NKU Campus.

To conclude the meeting, the Stantec team asked the audience for resources to acquire data for the risk assessment map. The meeting ended by announcing that the Public Survey is available online.

The meeting adjourned at 4:02pm

Public Kick-Off Meeting
March 20, 2018
4:00pm - 6:00pm

Agenda

Welcome	**Jeff Baker, Safety & Emergency Management**
Hazard Mitigation Planning 101	**Josh Human, Stantec**
Hazard Identification	**John Bucher, Stantec**

The hazard mitigation planning process is required under federal law to help communities better prepare for disaster events and to ensure communities are eligible for federal grants to support mitigation actions. Plans must be updated and approved every five years to maintain eligibility. This will be NKU's first hazard mitigation plan.

The completed plan will be submitted to the Kentucky Division of Emergency Management and the Federal Emergency Management Agency for approval prior to being submitted to Board of Regents for adoption.

Contacts

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Bucher, John

From: Jeffrey Baker <bakerje@nku.edu>
Sent: Monday, March 12, 2018 1:54 PM
To: Human, Josh; Bucher, John
Subject: FW: THIS WEEK AT NKU: March 12, 2018
Attachments: ATT00001.txt

From: nkunews-bounces@listserv.nku.edu [mailto:nkunews-bounces@listserv.nku.edu] **On Behalf Of** ThisWeek@nku.edu
Sent: Monday, March 12, 2018 10:10 AM
To: NKUNEWS@listserv.nku.edu
Subject: [NKUNEWS] THIS WEEK AT NKU: March 12, 2018

A publication from NKU Marketing and Communications.

THIS WEEK AT NKU
FACULTY & STAFF EDITION

SUBMIT: thisweek@nku.edu **DEADLINE:** Noon on Friday

OTHER ANNOUNCEMENTS

All Hazards Mitigation Plan Meeting March 20
Safety and Emergency Management will host a public meeting on Tuesday, March 20, at 4 p.m., to inform the campus community about the development of an All Hazards Mitigation Plan for the university. This plan will help the university better prepare for natural and man-made disaster events. The meeting will be hosted in Student Union Room 109. Presentations and literature will be provided to attendees explain the planning process and how the university community and local agencies can aide in data collection and hazard identification. The plan will outline areas that are at-risk on campus and determine vulnerabilities. The objective is to develop a program of activities and plans NKU may adopt to mitigate the university's vulnerability to natural and man-made hazards. For more information contact Jeff Baker at X-6522.

NKU 2018 Hazard Mitigation Plan Public Kick-Off Meeting

NKU 2018 Hazard Mitigation Plan / Public Kick-Off Meeting

Date/Time:	March 20, 2017 / 4:00 pm
Place:	NKU Campus -
Next Meeting:	Next Meeting Date
Attendees:	1
Absentees:	Absentees
Distribution:	Distribution List

Safety Moment: Enter safety moment here

Jeff Baker, NKU Safety and Emergency Manager started the meeting by briefly explaining the benefits of having a Hazard Mitigation Plan in place. The emphasis was place of the availability of federal funds through a federal grant where the federal government offers 75 %, the state offers 13% and the university is responsible for 12% for hazard mitigation projects. Jeff Baker mentioned that in December NKY put out a Request for Proposal to presented Stantec as the selected consulting firm to update and develop the NKU 2018 Hazard Mitigation Plan. Jeff baker Introduced Josh Human, John Bucher and Luisa Trujillo from Stantec.

Josh Human, Senior Hazard Mitigation and Resilience Leader at Stantec proceeded to give a presentation about Hazard Mitigation Planning. First, he emphasized the importance for a university to have a Hazard Mitigation Plan in place especially at the present time with the amount of disasters that have happened and the government fund availability. Josh asked the audience to introduce themselves.

The only person who attended this meeting was a Chemistry professor who expressed his concern due to the hazardous materials on campus.

Josh Human's presentation included a Hazard Mitigation 101 description, a clarification of the difference between risk and mitigation, and a detailed step by step explanation of the planning steps to complete the Hazard Mitigation Plan including Planning Process, Risk Assessment, Mitigation Strategy, Plan Maintenance and Plan Adoption. Josh Human also explained the Vulnerability Score and the tools used during the planning process.

Josh Human continued to go over each one of the hazards and ask the audience for input. Forest Wildfires, Drought and Mine Subsidence were dropped from the original list of hazards because they don't represent a risk for NKU Campus.

Stantec's Senior Planner John Bucher invited the audience member to look at three different maps to pinpoint exact risk locations.

To conclude the meeting, the Stantec team asked the audience for resources to acquire data for the risk assessment map. The meeting ended by announcing that the Public Survey is available online.

The meeting adjourned at 5:05 pm

Risk Assessment Meeting
June 6th, 2018
12:45pm – 3:45pm

Agenda	
Welcome	**Jeff Baker, Safety & Emergency Management**
Risk Assessment Overview	**Josh Human & John Bucher, Stantec**
Introducing the Mitigation Strategy	**Josh Human, Stantec**
Next Steps	**Josh Human, Stantec**

The hazard mitigation planning process is required under federal law to help communities better prepare for disaster events and to ensure communities are eligible for federal grants to support mitigation actions. Plans must be updated and approved every five years to maintain eligibility. This will be NKU's first hazard mitigation plan.

The completed plan will be submitted to the Kentucky Division of Emergency Management and the Federal Emergency Management Agency for approval prior to being submitted to Board of Regents for adoption.

Contacts

Jeff Baker, Director
Safety & Emergency Management
bakerje@nku.edu
859.572.6522

Josh Human
Stantec
josh.human@stantec.com
502.618.5873

John Bucher
Stantec
john.bucher@stantec.com
502.212.5044

Example Goals from Other University Plans

2013 University of Louisville Hazard Mitigation Plan:

Goal 1: Protect lives and minimize injuries from hazard events.

Goal 2: Protect university property and research data.

Goal 3: Ensure consistent funding sources for prevention, maintenance, and mitigation of disasters.

Goal 4: Enhance existing, or design new, university policies and technical capabilities that will mitigate and reduce damages from hazard events.

Goal 5: Build stronger external partnerships between government, educational institutions, business, and the general public.

Goal 6: Increase public and university awareness of, and support for, disaster preparedness practices

2014 Kentucky State University Hazard Mitigation Plan:

Goal 1: Protect and minimize injuries from hazard events.

Goal 2: Protect university property and research data.

Goal 3: Ensure consistent funding for disaster management.

Goal 4: Increase staff capacity, policies, and technical capabilities for mitigation.

Goal 5: Build external partnerships with government, educational institutions, business, and the community.

Goal 6: Build awareness and educate on disaster preparedness.

2016 University of Kentucky Hazard Mitigation Plan:

Goal 1: Protect lives and reduce injuries from hazards and threats.

Goal 2: Protect university property, organizational information, and research from hazards and threats

Goal 3: Enhance existing or develop new university policies and practices that are designed to reduce damaging effects from hazards and threats.

Goal 4: Build stronger partnerships between government, educational institutions, business, and the community.

Goal 5: Build disaster preparedness through mitigation education and outreach.

2012 KCTCS Hazard Mitigation Plan

Goal 1: Attempt to minimize the loss of life and injuries that could be caused by natural hazards.

Goal 2: Protect KCTCS property and research data from damage that could be caused by natural hazards.

Goal 3: Enhance existing or develop new system-wide policies and technical capabilities that will reduce damaging effects of natural hazards.

Goal 4: Continue to build and strengthen partnerships and synergies among KCTCS agencies, state and local governments, the campus community and the general public to promote effective mitigation strategies in a comprehensive and collaborate effort.

Goal 5: Increase campus community understanding of natural hazard mitigation through the promotion of mitigation education and awareness of natural hazards.

Bucher, John

From: Jeffrey Baker <bakerje@nku.edu>
Sent: Wednesday, May 23, 2018 3:10 PM
To: Curtis Keller; Timothy Ferguson; Lori Mcmillin; Syed Zaidi; John Gaffin; Arnie Slaughter; Blaine Gilmore; Rose Tempel; Jackson Meeks; Gina Rittinger; Dannie Moore; Anita Southwick; Raymond Mirizzi; Lori Southwood; Benjamin Jager; Christopher Hafling; Francois LeRoy; James Kaufman; Rebecca Lanter; Sarah Aikman; Darren Stearns; Ryan Padgett; Russell Kerdolff; 'wbirkenhauer@hhky.com'; 'slehman@hhky.com'; 'wturner@campbellcountyky.org'; 'trmatl2@uky.edu'; 'dwhibb0@email.uky.edu'; 'dan.schultz@cccfd.org'; Sami Dada; Matthew Zacate; Kathryn Lovold; 'emily.carnahan@nkadd.org'; STEPHEN MEIER; 'Grinstead, Nick (nick.grinstead@uky.edu)'
Cc: Human, Josh; Bucher, John
Subject: RE: Stakeholder Meeting - Save The Date

Good Afternoon,

For those unable to attend the stakeholder meeting on June 6th, I ask that you consider sending an alternate in your place. Input from each of your areas is valuable and ensures that we have the correct data to properly assess our vulnerabilities and prioritize our mitigation efforts. Your time and participation with this process is greatly appreciated.

Kind regards,

Jeff Baker

Jeffrey P. Baker
Director, Safety and Emergency Management
70 Campbell Drive, MA 134
Highland Heights, KY 41099
(859)572-6522

Instructors/Facilitators MUST sign each page of the Event Roster

Kentucky Division of Emergency Management
Event Roster

Name of Event: NKU Risk Assessment Meeting
Location: NKU Student Union
Address:
City/Community: NKU
EDBS#/NEXS#:

Is This An Exercise? ☐ Yes X No
If so, what type:
☐ Seminar ☐ Workshop ☐ TTX ☐ Game
☐ Drill ☐ Functional ☐ Full-Scale

Event Start Date: 6-Jun-18
Event End Date: 6-Jun-18
Instructor/Facilitator (1): ~~John Human~~ Josh Human
Instructor/Facilitator (2):
Total Event Hours:
Event Hours: Day 1: 3 Day 2:____ Day 3:____ Day 4:____ Day 5:____

If registering day-of, please print your name and email address legibly. The name on your certificate will appear as written.

Initials Only, Each Day

	FirstName	MI	Last Name	Title	Agency	Are you being Paid to attend?	If Yes, By Whom?	Email	Job Category	Day 1	Day 2	Day 3	Day 4	Day 5	Total Hrs.
0	John	Q	Doe	SAR Coordinator	XYZ County	Yes	Local	JQD@xyzcorporation.bus	SAR Supervisor						0
1	RYAN	C	STRAUS	SPECIALIST	NKU										
2	Russell	A	Kerdolff	Comptroller	NKU		NKU	Strausr2@nku.edu	Procurement						
3	DARREN		STEARNS	GM	BB&T ARENA		NKU	kerdolffr@nku.edu	Administrative						
4	Steve		LEHMAN	Public Works Director	CITY OF H.H.		NKU	dstearns@thebbtarena.com							
5	Becky		Jonter	Director	NKU		City	SLEHMAN@HHKy.com							
6	William		MOULTON	Director Intern	NKU		NKU	jonterr1@NKU.edu							
7	David		Berland	Director	NKU		NKU	moultonw1@nku.edu							
8	Lauren	A	Franzen	Director, HR	NKU		NKU	berlandd1@nku.edu							
9	Lori		McMillin	Business Mgr IT	NKU		NKU	franzenla@nku.edu							
10	Ryan		Padgett	AVP Enrollment	NKU		NKU	mcmillinl1@nku.edu							
11	Francois		LeRoy	[illegible] Affairs	NKU		NKU	padgettr1@nku.edu							
12	Rose	A	Tempel	Int Dir/NP Health Svs	NKU		NKU	leroy@nku.edu							
13	Chris	D	Hafling	Assoc. AD	NKU		NKU	tempelr1@nku.edu							
14	Dannie		Moore	AVP Student Affairs	NKU		NKU	haflingc1@nku.edu							
15	Rochelle	W	Shields	Assoc. Dir. Housing	NKU		NKU	moored8@nku.edu							
16	Arnie	D	Slaughter	Dean of Students	NKU		NKU	shieldsr3@nku.edu							
17	Chris	L	Tambling	Assoc. Dir of Student Union	NKU		NKU	slaughter@nku.edu							
18	Josh		Human		Stantec		NKU	tamblingc1@nku.edu							
19	Jeff		Baker	Director, Safety & EM	NKU	Yes		josh.human@stantec.com							
20						Yes	Nku	bakerjc@nku.edu							
21															
22															
23															
24															
25															

Instructor/Facilitator Signature: [signature]

Page: _______ of _______
Ver 8 Rev 12/2013

Co-Instructor/Facilitator Signature:____________________

Instructors/Facilitators MUST sign each page of the Event Roster

Kentucky Division of Emergency Management
Event Roster

Name of Event: NKU Risk Assessment Meeting
Location: NKU Student Union
Address:
City/Community: NKU
EDBS#/NEXS#:

Is This An Exercise? ☐ Yes X No
If so, what type:
☐ Seminar ☐ Workshop ☐ TTX ☐ Game
☐ Drill ☐ Functional ☐ Full-Scale

Event Start Date: 6-Jun-18
Event End Date: 6-Jun-18
Instructor/Facilitator (1): ~~John Human~~ Josh Human
Instructor/Facilitator (2):
Total Event Hours:
Event Hours: Day 1: 3 Day 2:____ Day 3:____ Day 4:____ Day 5:____

If registering day-of, please print your name and email address legibly. The name on your certificate will appear as written.

Initials Only, Each Day

	FirstName	MI	Last Name	Title	Agency	Are you being Paid to attend? If Yes, By Whom?	Email	Job Category	Day 1	Day 2	Day 3	Day 4	Day 5	Total Hrs.
26	STEPHEN	A	MEIER	Interim Dir. Campus Rec	NKU									
27	Pat		McGrath	Associate Dir. Campus Rec	NKU	NKU								
28	Anita	K	Southwick	Mgr. Research Comp	NKU	NKU	mcgrathp2@nku.edu							
29	Matthew	O.	Zacate	Fac. Senate Pres.	NKU	NKU	southwicka1@nku.edu							
30	Gina	L.	Rittinger	AVP, Mar Comm	NKU	NKU	zacatem1@nku.edu							
31	Thomas	L.	Ramstetter	Mar Comm	NKU	NKU	rittingerg1@nku.edu							
32	Curtis		KELLER	Director Parking Services	NKU	NKU	ramstetter@nku.edu							
33	Jim	M	KAUFMAN	DIRECTOR	NKU	NKU	kellerc1@nku.edu							
34						NKU	kaufmanj2@nku.edu							
35														
36														
37														
38														
39														
40														

NKU 2018 Hazard Mitigation Plan Risk Assessment Meeting

NKU 2018 Hazard Mitigation Plan

Date/Time:	June 6, 2017 / 1:00 pm
Place:	NKU Campus -
Next Meeting:	Next Meeting Date
Attendees:	27

Jeff Baker, NKU Safety and Emergency Manager started the meeting by welcoming the attendees and giving a brief explanation of the project

Josh Human then asked the attendees to introduce themselves and tell the group how their role related to hazard mitigation on campus. Josh gave a brief introduction to hazard mitigation planning, the Disaster Mitigation Act of 2000, and the FEMA Local Mitigation Planning Handbook. He then gave an overview of the risk assessment process and hazard identification.

John Bucher then presented the details of the risk assessment methodology including the exposure score and hazard risk score. He then showed a few examples of the maps created to demonstrate the results of the risk assessment. At that point the attendees were asked to look at the maps to check for accuracy and provide additional details where possible. Feedback included:

- Nunn Hall's content value is too high
- Founders Hall should have a condition score of 1 because of renovation
- Founders content value needs to be updated
- There was a storm/wind incident that caused a tree to fall on the intramural field
- The intramural field replacement value is about $2million
- The baseball field replacement value is about $750,000
- The soccer field replacement value is about $700,000
- The softball field replacement value is about $150,000
- The tennis courts replacement value is about $150,000.
- The mapped hazmat sites need to be verified

Josh Human introduced the mitigation strategy, including mitigation goals, mitigation actions and the action plan. He then led the attendees in an exercise to draft NKU's mitigation goals. The group settled on the following goals and will review them prior to the next meeting.

1. Pursue consistent funding from a variety of sources for prevention, maintenance, and mitigation of disasters.
2. Increase public and university awareness through education and support for disaster preparedness practices.
3. Enhance staff capacity and collaboration, policies, and technical capabilities that will mitigate and reduce damages from hazard events.
4. Protect university property, organizational information, and research assets from hazards and threats.
5. Build and sustain partnerships between government, educational institutions, business, and the community.
6. Protect lives and minimize injuries that could be caused by hazard events.

Josh then asked the group if they had any questions.

Question about what was meant by “consistent funding sources”

This means regular grant application (FEMA and other), capital improvements, and operational budgets if available

Question about what type of public awareness and education are intended

These could include websites, trainings, and student orientation

Josh then introduced the mitigation strategy and the mitigation action workbook. He informed the group that he will email the workbook and ask them to add possible mitigation actions.

He told the group that he will be sending another announcement about the survey, because we had very few complete surveys so far.

The meeting ended at 4:00 pm.

Mitigation Strategy Meeting
September 27, 2018
1:00 pm

Agenda	
Welcome	**Jeff Baker, Safety & Emergency Management**
Mitigation Strategy Overview	**Josh Human, Stantec**
Small Break Out Groups	**All**
Next Steps	**Josh Human, Stantec**

The hazard mitigation planning process is required under federal law to help communities better prepare for disaster events and to ensure communities are eligible for federal grants to support mitigation actions. Plans must be updated and approved every five years to maintain eligibility. This will be NKU's first hazard mitigation plan.

The completed plan will be submitted to the Kentucky Division of Emergency Management and the Federal Emergency Management Agency for approval prior to being submitted to Board of Regents for adoption.

Contacts

Jeff Baker, Director
Safety & Emergency Management
bakerje@nku.edu
859.572.6522

Josh Human
Stantec
josh.human@stantec.com
502.618.5873

John Bucher
Stantec
john.bucher@stantec.com
502.212.5044

Goals Identified during our last meeting:

1. Pursue consistent funding from a variety of sources for prevention, maintenance, and mitigation of disasters.
2. Increase public and university awareness through education and support for disaster preparedness practices.
3. Enhance staff capacity and collaboration, policies, and technical capabilities that will mitigate and reduce damages from hazard events.
4. Protect university property, organizational information, and research assets from hazards and threats.
5. Build and sustain partnerships between government, educational institutions, business, and the community.
6. Protect lives and minimize injuries that could be caused by hazard events.

Bucher, John

From: Jeffrey Baker <bakerje@nku.edu>
Sent: Monday, September 10, 2018 10:50 AM
To: Curtis Keller; Timothy Ferguson; Lori Mcmillin; Syed Zaidi; John Gaffin; Arnie Slaughter; Blaine Gilmore; Rose Tempel; Jackson Meeks; Gina Rittinger; Dannie Moore; Anita Southwick; Lori Southwood; Benjamin Jager; Christopher Hafling; Francois LeRoy; James Kaufman; Rebecca Lanter; Sarah Aikman; Darren Stearns; Ryan Padgett; Russell Kerdolff; 'wbirkenhauer@hhky.com'; 'slehman@hhky.com'; 'wturner@campbellcountyky.org'; 'trmatl2@uky.edu'; 'dwhibb0@email.uky.edu'; 'dan.schultz@cccfd.org'; Sami Dada; Matthew Zacate; 'emily.carnahan@nkadd.org'; STEPHEN MEIER; 'Grinstead, Nick (nick.grinstead@uky.edu)'; William Moulton; Sue Murphy-Angel
Cc: Human, Josh; Bucher, John
Subject: RE: Hazard Mitigation Actions
Attachments: Mitigation_Action_Questions_Examples.docx; Mitigation_Action_Workbook_Instructions_NKU.docx; NKU_Mitigation_Strategy_Workbook.xlsx

Dear Stakeholder Group,

As a reminder, our next meeting is scheduled for September 27th at 1pm. Please note the change in location to University Center Room #135.

Please take some time prior to the meeting to add items to the mitigation strategy workbook and send to Josh.human@stantec.com. There are many projects that can be associated to hazards so do not hesitate to add something you are unsure of. I have attached the tools to help.

We look forward to seeing you and appreciate your continued participation! If you are unable to attend, please send an alternate to represent your area.

Thank you,

Jeffrey P. Baker
Director, Safety and Emergency Management
70 Campbell Drive, MA 134
Highland Heights, KY 41099
(859)572-6522

Instructors/Facilitators MUST sign each page of the Event Roster

Kentucky Division of Emergency Management
Event Roster

Name of Event: NKU Risk Assessment Meeting
Location: NKU Student Union
Address:
City/Community: NKU
EDBS#/NEXS#:

Is This An Exercise? ☐ Yes X No
If so, what type:
☐ Seminar ☐ Workshop ☐ TTX ☐ Game
☐ Drill ☐ Functional ☐ Full-Scale

Event Start Date: 27-Sep-18
Event End Date: 27-Sep-18
Instructor/Facilitator (1): Josh Human
Instructor/Facilitator (2):
Total Event Hours: 3.0
Event Hours: Day 1: 3.0 Day 2:____ Day 3:____ Day 4:____ Day 5:____

If registering day-of, please print your name and email address legibly. The name on your certificate will appear as written.

Initials Only, Each Day

	FirstName	MI	Last Name	Title	Agency	Are you being Paid to attend?	If Yes, By Whom?	Email	Job Category	Day 1	Day 2	Day 3	Day 4	Day 5	Total Hrs.
0	John	Q	Doe	SAR Coordinator	XYZ County	Yes	Local	JQD@xyzcorporation.bus	SAR Supervisor						0
1	Jeff	P	Baker	Director	NKU	Yes	NKU	bakerjc@nku.edu		[illegible]					
2	Josh		Human	PM	Stantec	Yes	Stantec	josh.human@stantec.com							
3	ANDY		DOBSON	SR. PLANNER	STANTEC	YES	STANTEC	andy.dobson@stantec.com							
4	JIM		Kaufman	Director	NKU	Yes	NKU	KaufmanJ2@nku.edu							
5	Syed	S	ZAIDI	AVP – FM	NKU	YES	NKU	zaidi@NKU							
6	Lori		McMillin	IT	NKU	yes	NKU	McMillinL1@nku.edu							
7	Becki		Lanter	Director, Energy Mgt	NKU	yes	NKU	lanterr1@nku.edu							
8	RYAN	C	STRAUS	SPECIALIST – PROC.	NKU	YES	NKU	strausr2@nku.edu							
9	STEVE		LEHMAN	Public Works Director	HIGHLAND HEIGHTS	Yes	H.H.	SLEHMAN@HHKY.COM							
10	BILL		MOULTON	ASS. DIR. O+M	NKU	Yes	NKU	moultonw1@nku.edu							
11	Shoman		Kee	Director, Campus Rec	NKU	yes	NKU	kees1@nku.edu							
12	DARREN		STEARNS	GM BB&T ARENA	NKU	Y	SMG/NKU	dstearns@thebbtarena.com							
13	David		Berland	Director of Univ. Housing	NKU	Yes	NKU	berlandd1@nku.edu							
14	Anita		Southwick	Mgr. Res Compl	NKU	Y	NKU	southwicka2@nku.edu							
15	Tina		Altenhofen	Ex Assistant	NKU	Y	NKU	altenhof@nku.edu							
16	Matthew		Zacate				NKU								
17	Rose		Tempel		NKU	Y	NKU								
18	Chris	L.	Tambling	Assoc. Dir. Student Union	NKU	X	NKU	tamblingc1@nku.edu							
19	Chris		Hafling	Associate AD	NKU	+	NKU	haflingc1@nku.edu							
20	Anna		Wright	Director of P.R.	NKU	X	NKU	wrighta15@nku.edu							
21	TOM		Ramstetter	Director of Int Communication	NKU	Y	NKU	ramstetter@nku.edu							
22	François		LeRoy	Exec. Director Center for Civic Engagement	NKU	Y	NKU	leroy@nku.edu							
23	JOHN		GAFFIN	CHIEF OF POLICE	NKU	X	NKU	gaffinj@nku.edu							
24															
25															

Instructor/Facilitator Signature: R. Paul Human

Page: ____ of ____
Ver 8 Rev 12/2013

Co-Instructor/Facilitator Signature:__________________

NKU 2018 Hazard Mitigation Plan Mitigation Strategy Meeting

NKU 2018 Hazard Mitigation Plan

Date/Time:	September 27, 2018 / 1:00 pm
Place:	NKU Campus -
Next Meeting:	Next Meeting Date
Attendees:	27

Jeff Baker, NKU Safety and Emergency Manager started the meeting by welcoming the attendees. Josh Human, from Stantec started the Mitigation Strategy reminded the audience about the importance of having a Hazard Mitigation Plan in place. He asked the audience to briefly introduce themselves since new people joined the meeting.

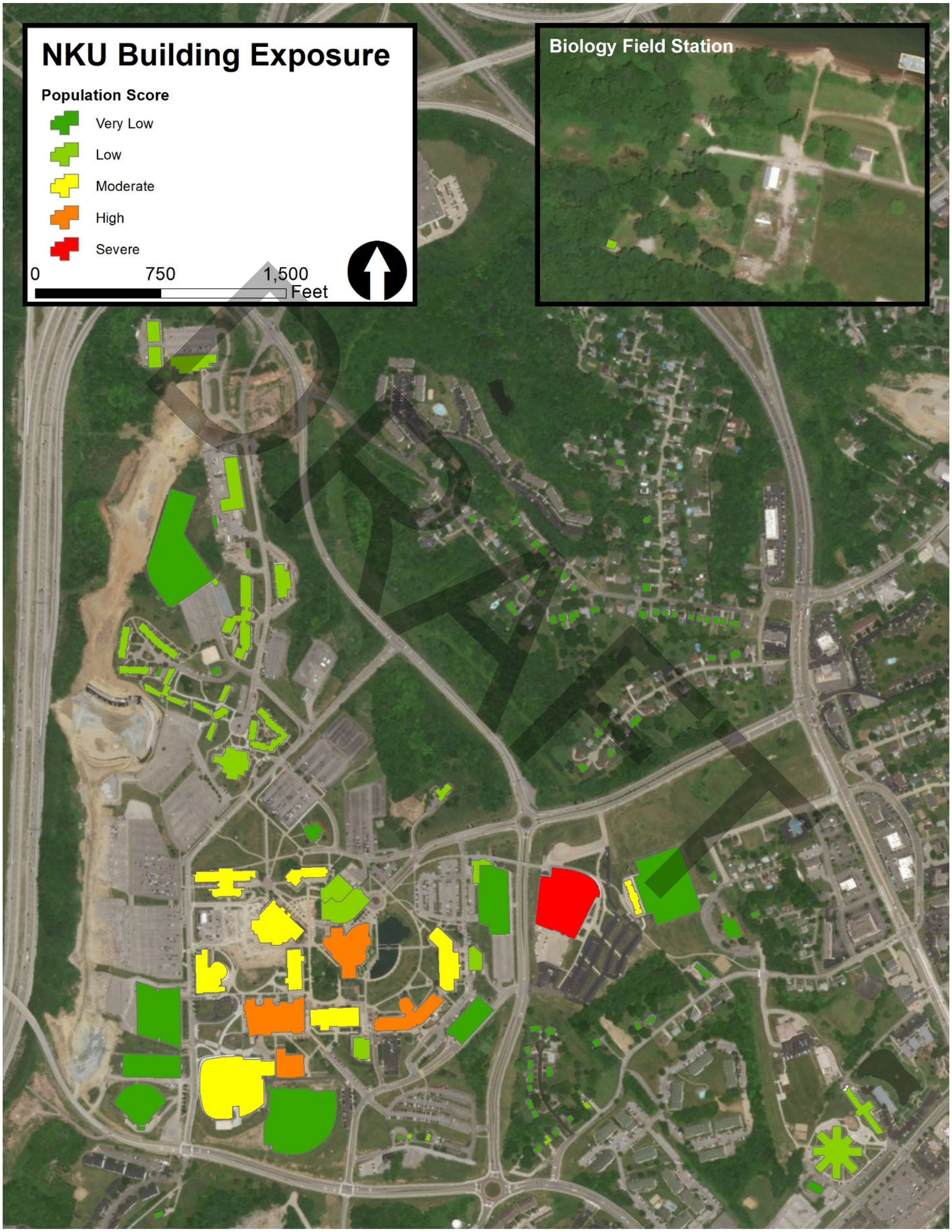
Josh introduced the concept of mitigation strategy and presented examples of mitigation strategy actions plans from the University of Kentucky and the University of Louisville. The following activity was to divide the audience into small groups with a facilitator to discuss current mitigation strategies and come up with new ones.

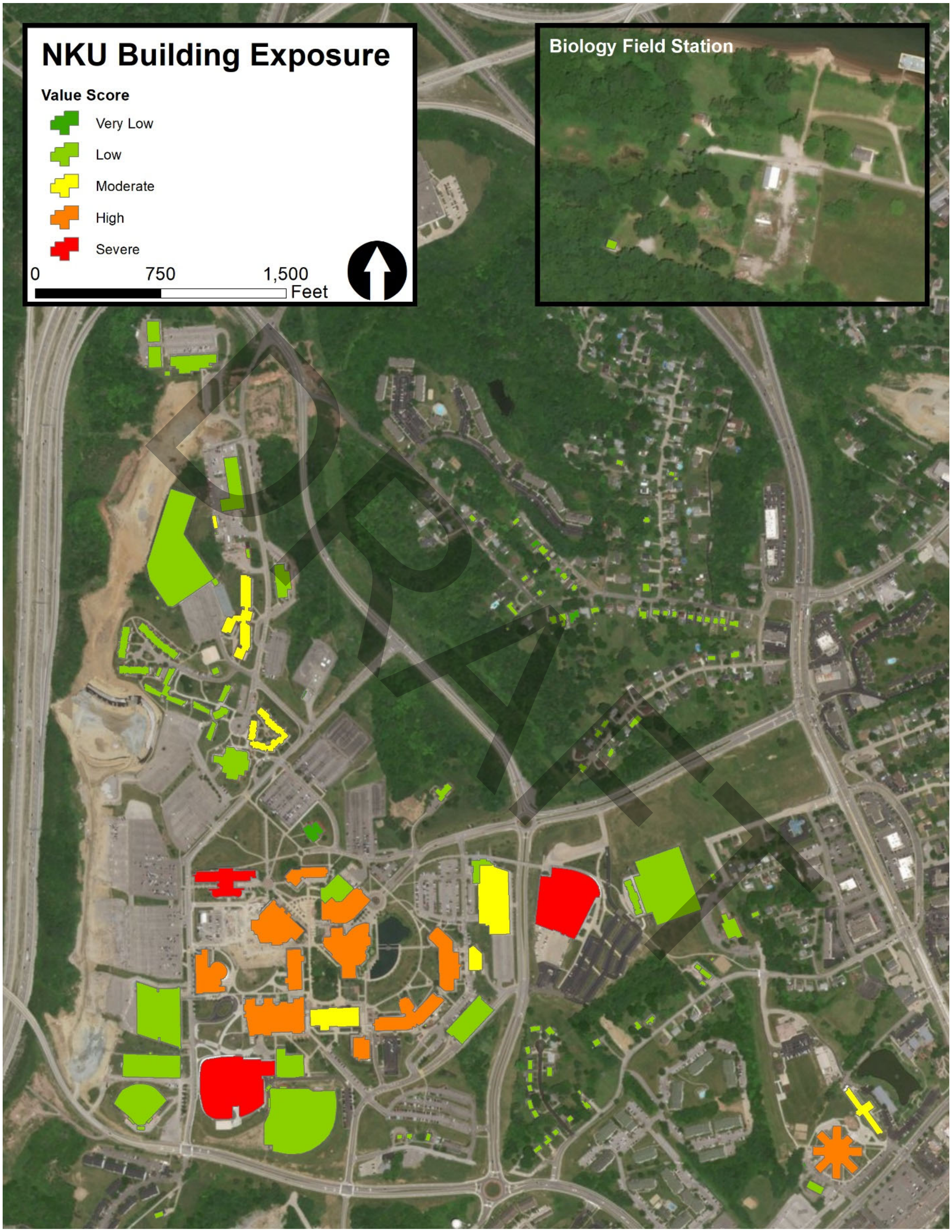
The facilitators were Andy Dobson, John Bucher, and Luisa Trujillo/ All of them are planners at Stantec. During the activity Josh Human and Jeff Baker went from table to table facilitating the discussion.

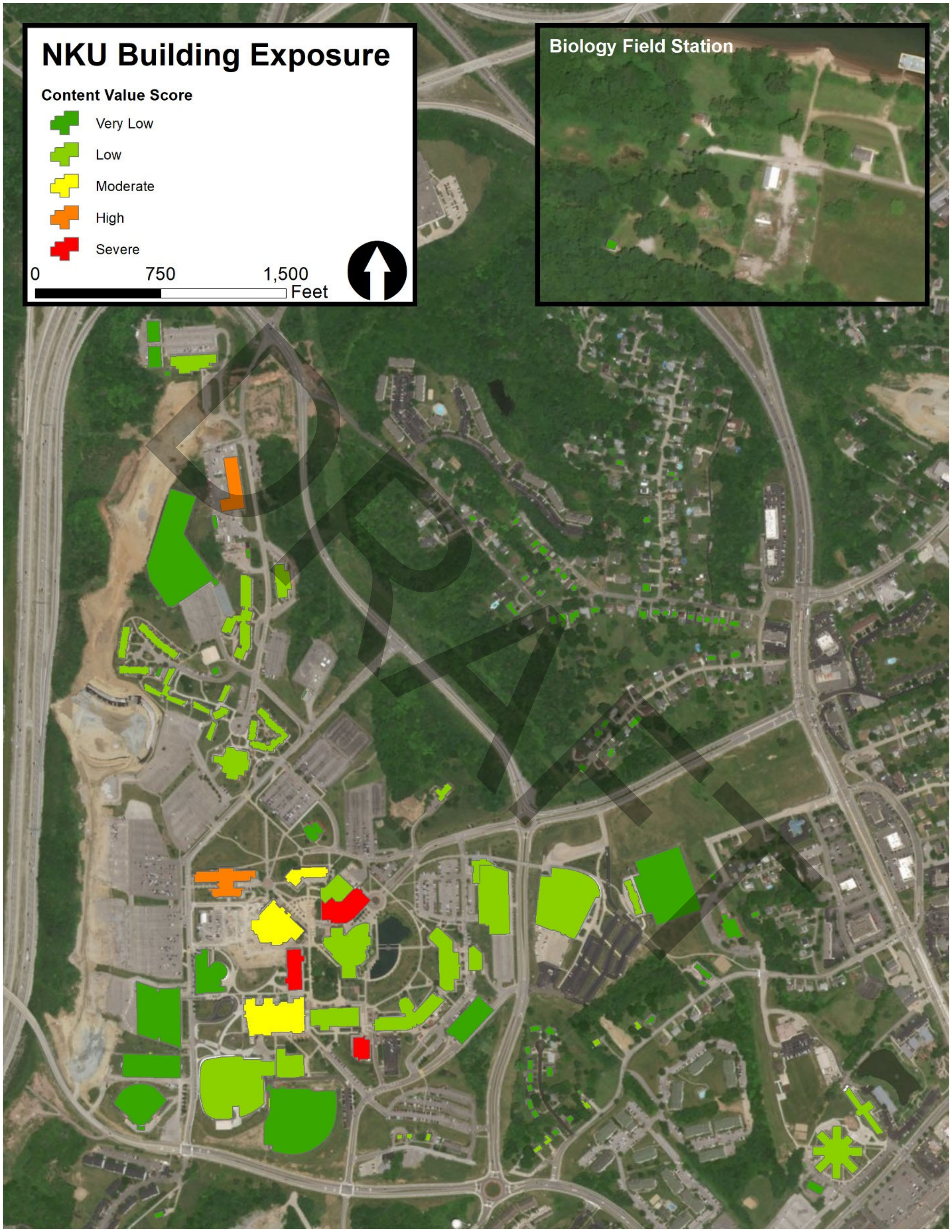
The meeting ended at 4:00pm.

Appendix C: NKU Stakeholder Group List and Attendance

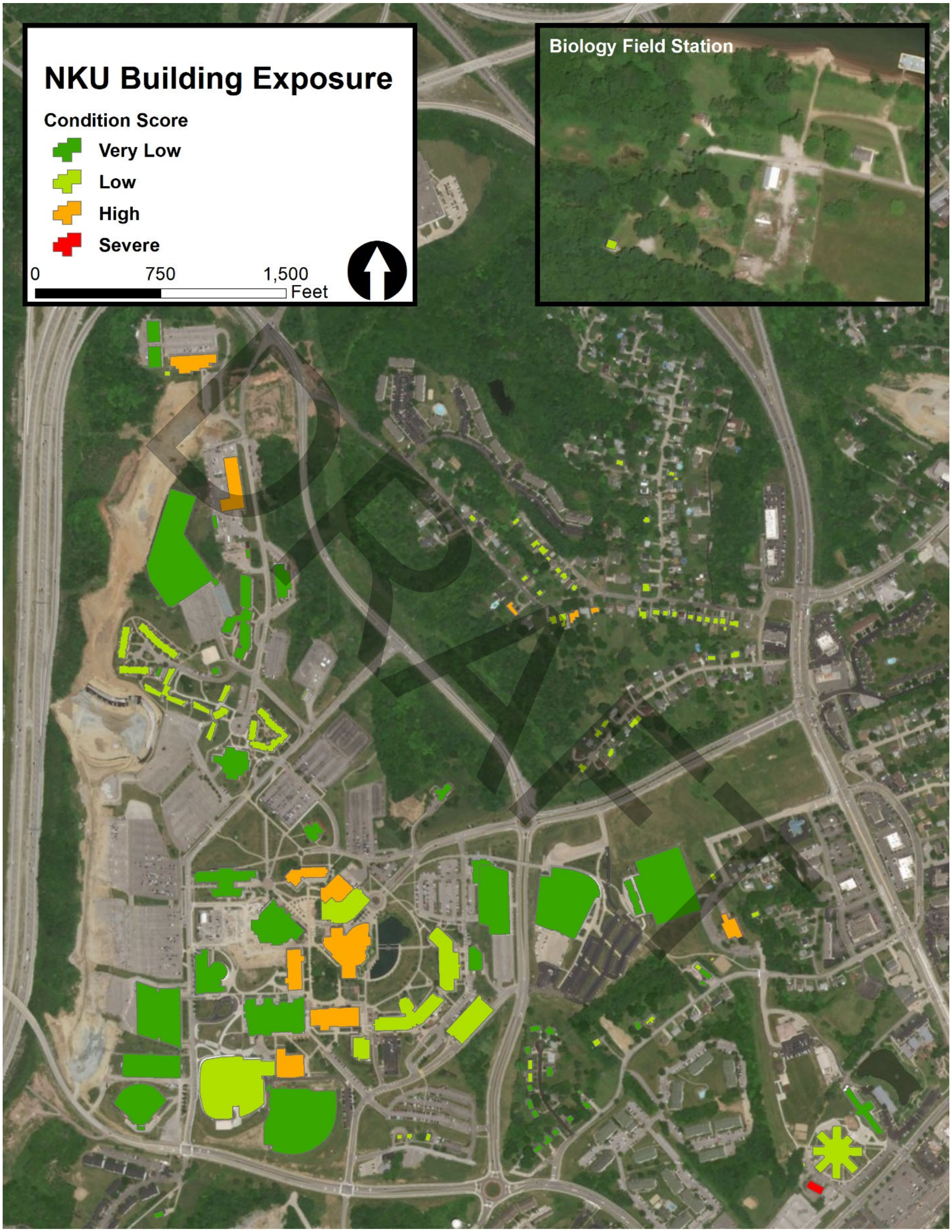
Appendix D: Exposure Maps




NKU Building Exposure
Value Score
Very Low
Low
Moderate
High
Severe
0
750
1,500
Feet
Biology Field Station
DRAFT


NKU Building Exposure
Content Value Score
Very Low
Low
Moderate
High
Severe
0
750
1,500
Feet
Biology Field Station
DRAFT


NKU Building Exposure
Critical Facility Score
Very Low
Severe
0
750
1,500
Feet
Biology Field Station
DRAFT


NKU Building Exposure
Condition Score
Very Low
Low
High
Severe
0
750
1,500
Feet
Biology Field Station
DRAFT

Appendix E: Mitigation Action Workbook Instructions

MITIGATION ACTION WORKBOOK OVERVIEW

The following document provides the instructions and definitions for each of the requirement elements to be captured in the '**Mitigation Action Workbook**' (excel document). The Mitigation Action Workbook will be used to capture hazard mitigation actions for the university's Hazard Mitigation Plan. The Mitigation Action Workbook is to be used as part of a strategic planning process and are designed to be:

- Completed electronically
- Developed and reviewed with your department
- Returned to contact person identified below

Please return all completed worksheets no later than August 27 to:

Josh Human
Josh.human@stantec.com

INSTRUCTIONS

Use the Mitigation Action Workbook to provide hazard mitigation actions to be included in the plan. Proposed actions should consider any needs that may reduce current and or future impacts of natural and non-natural hazard events. Each mitigation action should be entered as a separate project, policy or program within the spreadsheet. Ultimately, the Mitigation Action Workbook is intended to compile all university hazard mitigation needs into a single section (Mitigation Strategy) and serve as a blue print for reducing the University's overall vulnerability.

Action Description: Identify a specific action that, if accomplished, will reduce campus vulnerability. Actions may be in the form of policies (i.e., regulatory or incentive-based measures), programs and/or structural mitigation projects. Include key details such as site/building/location and any history of damages.

Hazard(s) Addressed: List the hazard(s) the proposed action is designed to mitigate against:

1. Earthquake
2. Extreme Heat
3. Extreme Cold
4. Flood
5. Hail
6. HAZ/MAT
7. Karst/Sinkhole
8. Landslide
9. Severe Storm
10. Severe Winter Storm
11. Tornado

Type: Indicate the mitigation category for the proposed action as discussed during the Kickoff Meeting (Please note a drop-down menu has been provided):

- Prevention
- Property Protection
- Natural Resource Protection
- Structural Projects
- Emergency Services
- Public Education and Awareness

Estimated Cost: Indicate the estimated cost to accomplish this action. If the cost is unknown or not applicable (e.g. creation of a policy), mark as $0 or "staff time." Please indicate the cost of the action based on the following criteria (Please note a drop-down menu has been provided):

- $0 - $4,999 (Low)
- $5,000 – $49,999 (Moderate)
- $50,000 - $249,999 (High)
- $250,000 – Above (Very High)

Benefits: Indicate whether the benefit of the action is "very high," "high," "moderate," or "low" based on the following general criteria (Please note a drop-down menu has been provided):

1. Enhance Life Safety
2. Protect Property
3. The Action is Technically Feasible
4. The Action is Political Feasible
5. The Action is Legal
6. Positive Environmental Impacts
7. Positive Social Impact
8. Administrative Capability
9. Local Champion
10. The Action Advances other University Objectives

Potential Funding Sources: Indicate how the cost to complete the action will be funded. For example, funds may be provided from existing operating budgets or general funds, a previously established contingency fund, a cost-sharing federal or state grant program.

Stantec

Lead Implementer and other Partners: Identify the lead department or organization that is best suited to implement the proposed action, as well as potential partner departments.

Timeframe: Describe a timeframe goal for completion. Please provide as much detail on the timeframe of this action as possible. For example, it could be an Action that is completed annually, or it could have a goal to be done in 2 or 5 years etc.

Edits: Provide your contact information for tracking purposes.

Stantec

NKU NORTHERN KENTUCKY UNIVERSITY

Appendix F: FEMA's Mitigation Action Evaluation Worksheet

Worksheet 6.1
Mitigation Action Evaluation Worksheet

Mitigation Action Evaluation Worksheet

Use this worksheet to help evaluate and prioritize each mitigation action being considered by the planning team. For each action, evaluate the potential benefits and/or likelihood of successful implementation for the criteria defined below.

Rank each of the criteria with a -1, 0 or 1 using the following scale:

- 1 = Highly effective or feasible
- 0 = Neutral
- -1 = Ineffective or not feasible

Example Evaluation Criteria

Life Safety – How effective will the action be at protecting lives and preventing injuries?

Property Protection – How significant will the action be at eliminating or reducing damage to structures and infrastructure?

Technical – Is the mitigation action technically feasible? Is it a long-term solution? Eliminate actions that, from a technical standpoint, will not meet the goals.

Political – Is there overall public support for the mitigation action? Is there the political will to support it?

Legal – Does the community have the authority to implement the action?

Environmental – What are the potential environmental impacts of the action? Will it comply with environmental regulations?

Social – Will the proposed action adversely affect one segment of the population? Will the action disrupt established neighborhoods, break up voting districts, or cause the relocation of lower income people?

Administrative – Does the community have the personnel and administrative capabilities to implement the action and maintain it or will outside help be necessary?

Local Champion – Is there a strong advocate for the action or project among local departments and agencies that will support the action's implementation?

Other Community Objectives – Does the action advance other community objectives, such as capital improvements, economic development, environmental quality, or open space preservation? Does it support the policies of the comprehensive plan?

Appendix G: Plan Maintenance Forms

The below form may be distributed to responsible university departments for the purpose of updating the status of action items. Another method of gathering updates to mitigation action items might be to distribute the "Mitigation Action Workbook" excel workbook to NKU Stakeholder Group to make direct changes.

Subject: Annual Report Status of Mitigation Action Items and Projects

Report Date: MM/DD/YYYY

Purpose of Annual Reporting: On an annual basis the Division of Planning and the Division of Emergency Management (DEM) has committed to tracking and monitoring action items on the Hazard Mitigation Plan (HMP) and the Floodplain Management Plan (FMP). As a responsible agency to the proposed action items, your cooperation in completing the below forms will allow DEM and Planning to conduct a thorough update on each mitigation project and action item.

Updating Your Projects: To find your agency's pre-identified mitigation projects and action items, please refer to the provided spreadsheet which lists mitigation action items and projects from the previous year. If your agency has procured new projects that are not listed and demonstrate the accomplishment of an action item, please provide information on the new project in one of the below forms. Please complete the below forms, save the document with your agency name and return to <name/agency name here> at <email address here>.

Name of Reporter:

Email Address:

Telephone #:

INDIVIDUAL PROJECT PROGRESS REPORT #1

Addressed Action Item: Refer to accompanying spreadsheet with listed action items.

Project Title:

Responsible Department: <Select Agency> **If other, please specify:**

Status of Project: <Select Status>

If stand-alone project, please enter dates:

Start Date: Click here to enter a date. **End Date:** Click here to enter a date.

Funding Source:

Cost of Project *<Type of Cost>* Enter amount here.

If this project is new, please describe: Enter project description here.

Problems/Obstacles & Proposed Corrective Action:

Additional Comments: Enter comments here.

The below form may be utilized for recording needed and anticipated amendments to the plan.

Northern Kentucky University Hazard Mitigation Plan

Plan Amendment Form

Amendment Sponsor: ____________________________________

Amendment #: ____________________________________

Date: MM/DD/YYYY

Current Text: ____

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Section:_____________________ Page__________ Line___________

Amended Text: ____

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Section:_____________________ Page__________ Line___________

Purpose of Amendment: ____

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Appendix H: Local Mitigation Plan Review Tool